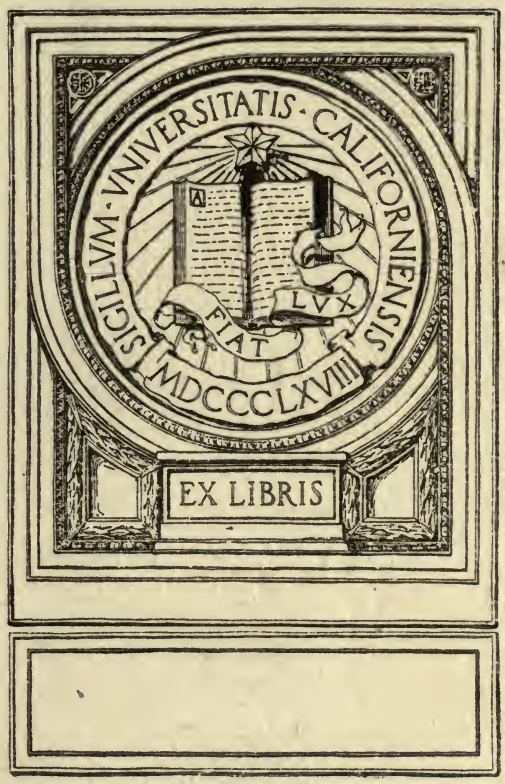


LECTURES TO PRINTERS' APPRENTICES

REPORTS OF A SERIES OF LECTURES DELIVERED AT THE NORTH END UNION SCHOOL OF PRINTING, CONDUCTED BY MASTER PRINTERS OF BOSTON

1908-1909

PRINTED AT THE SCHOOL OF PRINTING
NORTH END UNION, PARMENTER STREET
BOSTON, U. S. A.

PREFATORY NOTE

THE papers here printed are of some lectures on trade topics given at the North End Union School of Printing, Boston, during 1908 and 1909. The lectures were, with a few exceptions, given on alternate Tuesday afternoons, from 4.30 to 5.30 o'clock, and were arranged for apprentices and young printers who were regularly at work in printing offices, as well as for the pupils in the School. Employers and foremen were urged to allow young men to attend, and to let them off from their work earlier on the lecture days. Prizes were offered to apprentices in attendance for the best reports made of the lectures and much interest was evoked in making notes of what the speakers said.

To the lecturers and others who have assisted in this project of trade education, the management of the School offers grateful acknowledgments; the time and effort which they so generously gave have made possible the success of these Apprenticeship Lectures.

THE SCHOOL OF PRINTING, NORTH END UNION, 20 PARMENTER STREET, BOSTON

BOARD OF SUPERVISORS

J. STEARNS CUSHING, *J. S. Cushing & Co., Norwood*
GEO. H. ELLIS, *Geo. H. Ellis Co., 272 Congress St.*
J. W. PHINNEY, *American Type Fdrs. Co., Boston*
H. G. PORTER, *Smith & Porter Press, 530 Atlantic Av.*
GEO. W. SIMONDS, *C. H. Simonds & Co., Congress St.*
HENRY P. PORTER, *Oxford-Print, 148 High St.*
JOSEPH LEE, *Vice-Pres. Massachusetts Civic League*
SAMUEL F. HUBBARD, *Supt. North End Union*
A. A. STEWART, *Instructor*

THE SCHOOL OF PRINTING was established in January, 1900, by the North End Union, under the supervision of a number of leading master printers of Boston. It has had to demonstrate its purpose in practical results, and is gradually being recognized by those who realize the important need in the trade of such a method of technical instruction.

The purpose of the School is to give fundamental and general instruction in printing-office work, and to offer young men, through a system of indentured apprenticeship, an opportunity to learn the things which each year are becoming more and more difficult for the apprentice to obtain in the restricted and specialized conditions of the modern workshop.

The course of study embraces book, commercial, and advertising composition, and platen press work. The School is supplied with hand and job presses, roman and display types of various styles, and the usual furniture and material of a modern printing office. The hours are identical with those of a regular workshop, from 7.40 A.M. to 5 P. M., excepting Saturday afternoon. The tuition fee for one year is $100. Applicants must be sixteen years of age or over.

For further information address SAMUEL F. HUBBARD, 20 Parmenter Street, Boston.

CONTENTS

I

TYPOGRAPHIC DESIGN

TYPOGRAPHIC DESIGN

By HENRY LEWIS JOHNSON, *Editor of The Printing Art* :: :: :: :: :: LECTURE NO. I

WE stand on historic ground. When the record is made up showing the important events in the great industrial development upon which it is believed we have now entered, the revival of the apprenticeship system in the School of Printing of Boston will hold a prominent place. This present lecture course is still further indicative of the awakening of concern and interest in the advancement of standards in printing. It has too long been a case of shoemakers' children going barefoot. The printing press has always been a fundamental factor in all industrial and educational development, but literature dealing with printing, schools, and lecture courses have been sadly lacking.

Before discussing the subject of typographic design, we can well ask, "What does printing mean to us?" It cannot fail to command our enthusiasm and stir our deepest purpose for attainment if we understand how great a part it has in the affairs of the world. We must realize that there are a larger number of establishments engaged in printing than in any other single industry and there is not the tendency toward consolidation which has developed so much in other directions. A printer still has the opportunity for individual enterprise and attainment. Ranking as the seventh giant industry, printing shows a greater gain than any other — forty-two per cent in the last five years. I shall undertake to emphasize later some of the evidences of the ways in which the business affairs of the world are being conducted more and more through printing-press product. It is

now the underlying motive force and vehicle of business of national industries and individual affairs. In an interesting appreciation made by W. S. Rossiter, he says: "This industry [printing and publishing] may be termed the barometer of commercial prosperity. It differs from all other industries in that it deals with every calling and is closely identified with the prosperity of each. A manufacturer of shoes has but an academic interest in the piano industry; but both the shoemaker and the piano man are interested in advertising and printing. There are few callings indeed in which the intelligent or the careless use of these agents does not mean the difference between success and failure."

IMPORTANT COMMERCIAL DEVELOPMENT

No great enterprise or developments can be carried on without the printing press. When one of the Russian loans was to be placed in this country, special circulars, application forms, and many other documents were required for the portion allotted to Boston. Compositors and pressmen worked day and night to produce the necessary business vehicles for carrying through this transaction. Next to the bankers, the printers were the most important factors.

Bulletins and pamphlets issued by electrical companies are not merely specifications and price lists, but are in a sense scientific publications which give information about new methods of transmission or applications of electrical energy. They lead the way to new developments and indicate the necessary equipment.

The telephone books of our great cities are instances of the remarkable requirements in present-day

printing. The cities of New York, Chicago, and Philadelphia require approximately one million four hundred thousand books, representing an enormous amount of paper and presswork aggregating forty-two million impressions. Each edition would keep one press busy fourteen years.

Other instances of modern uses are the finely illustrated pamphlets issued by steamship and railway lines. Many of these are richly illustrated documents full of historical matter and as finely printed as the best of geographies and histories. It is reported that one European steamship line spends eighty thousand dollars yearly in stimulating travel by this method.

It is generally conceded that the greatest effort for attractive printing is in catalogues and souvenirs issued by commercial houses and manufacturers. A western threshing machine company has issued a finely bound book with a symbolic device of the sickle and sheaf for the cover design. The cover and end papers are straw color, the frontispiece is a reproduction of one of the old masters, illustrating the harvest field, while head-bands, marginal decorations and other illustrations show the development of harvesting methods. From the early days of the Nile valley to the broad plains of the West at present, in design, illustration and typography, this book represents the high standard of modern printing-press product.

The Gorham Golf Book is one of the best examples of æsthetic quality and indirect advertising. It is devoted entirely to the official rules of golf, interspersed with miniature reproductions in color, illustrating the game. Finely printed and attractively bound, it is a souvenir which will be prized and

retained by everyone fortunate enough to receive it. Automobile catalogues are becoming conspicuous for fine design, excellence in mechanical illustration and general style. Catalogues relating not only to industrial art products and the so-called luxuries, but the most business-like publications dealing with purely mechanical appliances, are produced with a similar use of design, color, and high mechanical standards. This characteristic of business literature must not be overlooked nor minimized by the printer or the apprentice. It means that the mechanics of printing must be supplemented by other elements which constitute quality. This is all embraced in the two functions which printing serves—to convey (1) thought, and (2) feeling.

Some of the elements of type design can be expressed more clearly by formulation.

TYPOGRAPHIC ELEMENTS

Kind of Type	Appropriateness Use of Series Degree of Contrast
Arrangement	Architecture Balance Who, What, When, Where
Feeling . . .	Style Decoration Color Papers

Appropriateness is given the most prominence because it is the first element of efficiency. The use of a series of type is characteristic of the best work,

not only because it looks well, but because it maintains a better balance between the various features, emphasis being gained by the necessary difference in size, rather than in types. which tend to confuse. The degree of contrast must be adjusted to the relative importance of the display features. The tendency now is for less emphasis in display and more liberal use of white space and margins.

Of the specifications under Arrangement, architecture is a general term which can be applied to the construction of a form, and at the same time it should have a specific significance. The laws and precedents of architecture can be studied to advantage. We must know about the typographic accessories, such as florets, borders, initials and head-bands. These all represent some style of ornament and must be appropriate to the accompanying type. The proper basis of ornament is the study of architecture. According to James Ward, "The best ornament the world has ever seen has been constructed and is based on the laws that govern architecture."

The question of balance depends upon the cultivation of feeling for it. The centre of gravity of the page must always be above the geometrical centre, and where panel forms are used at the top and bottom of the page, by far the greater weight is in the upper panel.

The suggested arrangement of "Who, What, When, Where" is that proposed by Mr. De Vinne as a guide to the compositor in determining the important display lines of an announcement or circular. It is not always possible to follow just this order, but an effort must be made to determine what are the important points.

Under the heading of Feeling are embraced the elements which contribute to attractiveness. New types or the excellent handling of standard faces may have freshness and attractiveness and yet avoid all eccentricity. Some of the worst features of typography are due to the abundance of decorative material which leads to the use of ornaments which do not harmonize with the accompanying type. Heavy decorations, such as the Jenson ornaments, are used with light faced Roman types, and heavy initials overbalance text letters in the same manner. The period of ornament adopted should harmonize with the character of type, and the use or misuse of ornament at once reveals the taste and discrimination of the compositor.

In the modern effort to secure attention and make a favorable impression, color has a new importance. A large portion of commercial forms are displayed in two colors, while catalogues are often in two or more colors throughout. Among every season's holiday books are many which have decorative titles, initials, and borders in color. These must be appropriate and well-balanced with relation to the accompanying type matter. The danger is too much rather than too little color. Strong contrasts must be avoided, as they are usually offensive. Black and red are the standard for rubrication, and yet great discrimination is required in the choice of red. The orange and light reds are usually more successful than dark shades.

It is said that of the several kinds of beauty the eye takes the most delight in colors. Further, "Nothing reveals the culture of the individual and the country more than color."

There are some well-defined tendencies in color for borders, titles, and footnotes accompanying three- or four-color illustrations. Gray inks are used, browns, greens, and grays being found in great variety in borders, decorations, and rule work of catalogue pages. There is also endless variety in covers, the stock itself and strong complementary colors being combined attractively. With many of the darker and more subdued cover stocks, harmonious color schemes are arranged, giving rich effects. A good color sense can be acquired only by the study of the principles which are involved in the use of color in design and painting. The ability to use color is becoming an important equipment both for the typographer and pressman.

The possibilities of producing attractive printing have been immensely increased in recent years by the new varieties of papers. For catalogues and pamphlets there are many grades of stock, some hard and highly finished for bronze and full color; others in soft texture and subdued tones for light and harmonious color schemes. In text pages, the machine-finished and super-calendered stocks have been supplemented by antique, wove and laid, plate, linen surface, and crash finishes. Many of these papers have the characteristics of color, pliability, and texture which distinguish hand-made papers. Much attractive work is produced by the simplest forms of typography, well printed upon some of the new papers, which contribute a feeling of quality and distinction.

There must be a careful adjustment between the size and kind of typography and the texture of the paper. Small and light faced types require smooth

or plate finished papers, while strong display or mediæval book effects are best on antique papers.

PERSONAL EXPRESSION

It is said that everything that a man does reveals himself. The printer must realize that while he is to convey the thought of the author in what he conceives to be the best form, he is also giving especial evidence of his own ability or lack of it. Printing is a personal expression on the part of the printer just as it is by the author. When we hold printing in adequate appreciation, we realize more fully our responsibilities and opportunities in using this fundamental factor in the world's affairs.

While the mechanics of printing have continued much the same in principle, styles and standards are constantly changing, especially since the days of photo-mechanical engraving process. The efficiency of modern printing depends more and more upon the design and fine adjustment which the printer makes of all the fundamental features of typography, illustration, paper, colors of ink, and binding. At no time can we rest upon such mechanical and artistic qualifications as we may have attained. One of the world's great masters, Michael Angelo, said, "Still I am learning," and Horace Fletcher advises us now, "If we are wise, we never leave school."

In conclusion, I commend to you the epitome by Mr. Stewart, "The printer: he who sticks truths on end and stamps them with a mighty impression upon the consciousness of his race."

II

BOOK COMPOSITION

BOOK COMPOSITION

By J. STEARNS CUSHING, *of the Norwood Press, Norwood, Mass.* :: :: :: LECTURE NO. II

PREVIOUS to the time movable type was used by Gutenberg and Faust for printing books, they were printed from engraved blocks, or were in manuscript form.

The first type was made to imitate, as closely as possible, the letters in the manuscript books, and the fonts contained many combination or double letters, such as we have to-day in ff, ffl, ffi, etc., and many abbreviations such as c$^{\text{us}}$ = cujus, q̃ = qui, q$^{\text{t}}$ = quod, q$^{\text{e}}$ = que, r$^{\text{m}}$ = rum, etc. This attempt by printers to imitate manuscript books was owing to the fact that printed books were not popular among book-buyers at first; they were considered cheap and degrading to art and literature. Those rich enough at that time to afford to buy books did not desire to have them made so cheaply that the poorer people could easily get them. The higher education of the common people was not then considered desirable.

Oftentimes blanks were left in the printed page at the beginnings of chapters, to be filled in later by hand with initials drawn in colors; and generally broad margins were left for hand decoration, which were sometimes only partially filled in and sometimes left blank altogether.

I have here a reproduction in colors of a page of one the first books of Gutenberg and Faust. It was the first book printed from movable type. It is beautifully decorated, but you will notice that only the text is *printed*, and that the initials and marginal decorations were painted in by hand.

I think it would be a very good idea, and would

repay the School of Printing and as many of the apprentices of other offices as can do so, to go to the the Public Library and look at the old manuscript and printed books displayed there in glass cases. There is much that you would not understand about them, but you would get many good ideas and cultivate your taste by examining them.

You will probably see there books which have had blank places left for initials, as mentioned before, and the space has not been filled in by the hand decorator; but in the middle of the blank space is a small capital letter printed, which was intended simply as a guide to the artist as to what letter should be drawn in.

Among the most helpful things to a compositor is a study of spelling, elementary English composition, and punctuation; and for the latter I know of no better or simpler or more comprehensive book than Bigelow's "Handbook of Punctuation." I would particularly warn you against attempting any use of Wilson's work on Punctuation. It is altogether too complicated for practical use and is more apt to confuse than to assist the student. I doubt if anybody but the author ever really comprehended its apparently conflicting rules and hair-splitting exceptions. In my experience as an apprentice and journeyman I found that at the University Press, where Bigelow's system was followed, the compositors were able to set "clean" proofs; which was an impossibility at John Wilson's,* where the Wilson treatise was supposed to be the guide for punctuation.

I also recommend the study of some Beginner's Latin book,—and so much of some Greek grammar as relates to the Greek alphabet and the accents and

* At this time (1868-1874) these places were two separate establishments.

breathings, which are the marks you see over Greek vowels.

All this is not so much of a task as would appear. One or two evenings spent in merely glancing over the books mentioned will show you how much valuable information, directly applicable to your work, can be gained, and how much your labors will be simplified, and how many unnecessary errors you can avoid, by a study of these subjects. Almost all compositors run across Greek words occasionally; they constantly run across Latin words. You will find not only that you can learn to set Greek quite easily, but the knowledge you gain by some study of these books will be of advantage to you in many other ways. These studies are also the best preparation for proofreading.

In the back part of Webster's Unabridged Dictionary you will find much useful information, particularly in the section on the signs used in the various sciences. These signs are classified as follows:

1. Astronomical
2. Botanical
3. Chemical
4. Mathematical
5. Medical
6. Miscellaneous
7. Monetary and commercial
8. Musical
9. Typographical

Every compositor should familiarize himself with the meanings and names of these signs, for he is apt to meet them at any time in his work, and a knowledge of what they stand for will be not only helpful and instructive, but will make much otherwise dry typesetting positively interesting.

I would suggest to Mr. Stewart that he reprint from the dictionary this section on signs for the use of his pupils and other apprentices.

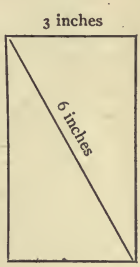
Abbreviations which are interesting but not in common use are the following:

7ber	for	September	from	Septem = 7.
8ber	"	October	"	Octo = 8.
9ber	"	November	"	Novo = 9.
10ber	"	December	"	Decem = 10.

Last, but not least, there is no better book for any printer's study, be he young or old, than De Vinne's "Correct Composition."

When a publisher sends the manuscript of a book to the printer, he generally has a fairly well-defined idea of what sort of a book he desires to produce, as to size and general appearance, and oftentimes he mentions, as a sample to be followed, some book which in type, size, and proportion of page, and in other details, meets his approval. But it also often happens that the customer has not decided upon these details, and desires the benefit of the advice and suggestion of his printer.

So I will talk on some of the everyday questions and practices which confront a compositor, and will try to give some simple rules for their solution.



SHAPE OF THE PAGE

In the absence of other directions for determining the proportions of the type page, an old rule was that the diagonal — that is, from corner to corner of the page — should measure twice the width.

You will find that this rule will always give a pleasingly symmetrical page.

Generally, however, the shape of the page is determined by the size of the paper upon which it is to be printed; and the size of the paper is made to suit the size and shape of the book desired by the customer.

LEADING AND SPACING

This is a very important factor in the making of a pleasing page. A safe rule to follow is to have the space between the words correspond to the space between the lines; that is, in a page leaded with two-point or three-point leads, the average space between words should be an en-quad; but, no matter how widely the lines may be separated, the word-space should never exceed an em-quad. On the other hand, a solid page should have an average spacing of three-to-em spaces. If the page is to be double or triple-leaded, you should space with an en-quad at first, and increase (rather than decrease) this space when necessary to fill out the line.

Lines of ordinary capitals should be spaced with two three-to-em spaces. Fat or extended type requires proportionately wider spacing than thin or condensed type. In all cases the spaces between words should be about equal to the average width of the letters you are setting up.

In one minor matter I am obliged to differ with Mr. De Vinne, in his "Correct Composition," and that is as regards his insistence on spacing such words as I 've, you 'll, 't was, 't was n't, 't is, 't is n't, etc., instead of printing them close; as, I've, you'll, 'twas, 'twasn't, etc. He does not, however, advocate spacing *don't*, *won't*, *can't*, *shan't*, etc.

To be sure, he provides that only thin spaces shall be used between the parts of these words; but even then, in dialect matter, where they occur frequently, the effect is not only unpleasant and confusing to the eye, but the difficulty of reading is much increased by the unnecessary separation of parts of a word which must be pronounced and treated as one word. And in practice I find the "thin-space" provision is more honored in the breach than in the observance, since even in books printed at the De Vinne Press, in nine cases out of ten, the spaces between the parts of these words are as wide or *wider* (not thinner) than the spaces between the words themselves. That this arbitrary spacing is not demanded by the publishers, or by the public in general, is proved by the fact that in thirty years' experience as a printer of books I recall but a single instance of its being insisted upon, and then simply for the sake of uniformity with books of the same series previously made by one of the very few remaining printers who follow such practices as printing *'t was n't* instead of *'twasn't*, but *shan't* instead of *sha' n't*. Why?

SELECTION OF TYPE

Of late years there has been a tendency to use varying styles of type in the same page — as, for instance, old-style running-titles or initials with modern-faced text type; or Caslon with modernized old-style, which is not so objectionable. If you wish to have a really harmonious book page — a page which will please everybody, they cannot tell just why — you will have the whole page, from top to bottom, one style of type, and you will avoid mixed styles. You will keep the faces entirely distinct, carrying out this principle of

uniformity of type even to your initial letters. And the general shape of your type, to secure perfect harmony, must conform to the shape of your page. The plainest book faces produce the best results in book pages. But if you have to choose between fat and lean type, remember to use fat type for an extra wide page and thin type for a narrow page. This applies to job work also.

RUNNING TITLES

Avoid startling effects and too much prominence. If the running title is set up in capitals of the text type, or one size smaller, a pleasing result is almost certain; or if lower-case is preferred, use a size larger (roman or italic) than the text type, but of the same series. If capitals are used, and the title is short, a thin space between the letters will improve its appearance.

Some years ago an Englishman named Morris, who was an artist, a writer, a poet, a student, and incidentally a socialist, decided that books were not made to suit him; so he started out to make them to his taste, and he made some decided changes in prevailing customs in book-making. He designed his own type, used only hand-made paper, and printed his books himself on a hand press. The pages were very closely set in heavy-faced type, and looked rather black; but the mechanical execution was nearly perfect. He had heavy decorative borders in the margins, and in many ways he imitated the old manuscripts to which I have drawn your attention. His books became celebrated, but they were very expensive. They attracted a great deal of attention, and book-collectors now pay almost any price for copies of them. But

their merit was mostly in their artistic and mechanical execution. As books for readers they were not a success, being too closely set to be easily read, and the mind of the reader was too apt to be distracted from the thought of the author by the unusual typography and over-decoration of the pages. A natural result of their success was that a lot of people tried to imitate Morris and make "marvellous" books; but most of them only succeeded in making absurd books, which had neither the merit nor perfect workmanship nor any other creditable feature of Morris's books.

The distinguishing marks of these books (by would-be Morris imitators) were startling effects in running titles, by the use of very large or odd or black type, put in unexpected places; half-titles in corners or tops of pages, where you would expect to find them in the centre; and the use of any old heavy-faced type for the text, set as solid as possible, with disproportionately broad margins — waste space which could much better be utilized between the words and lines for the sake of legibility; and many other fads and freaks calculated to attract attention. It certainly was "the arrogance of ignorance" in book-making while the fad lasted.

The best evidence of the fact that good taste and harmony in printing, as well as in other matters, appeal to most people, is that this era of freak book-making was doomed to an early grave, and the art of printing has again returned to a fairly normal condition.

EXTRACTS AND NOTES

Extracts — One size smaller type and thinner lead than text; or, if text is thin leaded, set solid. If the

text is solid, the extracts should be set in two sizes smaller type.

Footnotes — Generally three sizes smaller type than text, with thinner lead; and solid with solid text.

Cut-in and Marginal Notes — Type should generally be one size smaller than footnotes, unless more prominence is desired; in which case some small condensed antique or boldface may be used. In the case of cut-in notes it is best to set them up in advance, afterwards placing them in the text as it is set up. Do not attempt to space out to even lines in either cut-in or marginal notes, but leave them uneven at the right side.

BLANK LINE AT BOTTOM OF PAGE

Our customers often do not understand why printers always put a blank line at the bottom of a page. This blank line probably originated at the time it was the custom to repeat the first word of the next page at the bottom of the previous page, and a spare line was necessary for that purpose. Nowadays it is utilized for signature numbers and letters, and for folios or page numbers when necessary, as, for instance, on pages not carrying running titles.

Another reason for it is that among all first-class book-printers it has always been a rigid rule that a break-line (that is, the end line of a paragraph) must not come at the top of the page, and for that reason it was considered allowable to run it into the blank line at the bottom of the page. But if the break-line was nearly a full line, it was customary to go back a few lines and drive over enough words to make another line, and then to carry the two lines to the top of the next page. That a break-line should not

come at the top of the page has always been one of the rules which book-printers, until recently, have considered a part of their printing religion. Since Monotype and Linotype machines have been used for book-work, however, I regret to say that this rule is often broken.

THE USE OF INITIALS

Where plain or ornamental initials can be appropriately used, a great deal of taste can be shown in their selection. If a highly ornamented initial is used, be sure that the strength of the lines of the initial letter is in keeping with the face of the text type. A weakly defined initial letter, surrounded and obscured by a mass of ornamentation, will not look well with a strong-faced text type, such as the Scotch face. If a plain two-line or three-line initial letter is used, it should conform to the shape of the page, and to the face and shape of the text type selected. The top of it should align with the top of the capital letters of the first line of text type, and the bottom, if possible, should align with a line of the text. While this rule is often broken, it is still a breach of good taste to use an old-style initial letter with modern-faced type, or vice versa; and nothing (except eccentricity) can excuse the use of an italic initial with roman text.

CARE IN JUSTIFICATION AND EVEN SPACING

The best time to exercise this care is while the line is in the stick; and before passing on to the next line you should look it over carefully for typographical errors, and then space and justify it. This work never can be done easier or better than just at this time. In spacing out the line be careful also to distribute

the extra space equally between the various words, and not all at one end of the line, which, if done, makes one side of the page look very closely set and the other side correspondingly open.

CORRECTING ON GALLEY

If there are only a few simple alterations to make, such as turning reversed letters, or substituting one letter for another of the same size, it is only necessary to loosen the side stick of the galley and carefully lift with a bodkin the letter to be changed. But, as a general thing, by far the best plan is to lift each line requiring change into your stick. In this way you can get perfect justification, and the corrections can be made more quickly than in any other way.

The bodkin is an essential tool to the compositor, and if carefully used will do no harm; but tweezers should never be used to lift letters out of a line.

IMPOSITION AND MARGINS

(These subjects were illustrated by means of printed and folded sheets, and on the blackboard.)

PUNCTUATION

This is so lengthy a subject that I can but touch upon it here. The other day I noted an amusing instance, which shows how necessary some punctuation is at times. In a large Boston store the inscription under a picture of Admiral Dewey and Captain Bradley at Manila reads, "Fire Bradley when you are ready." History gives no particular reason why Bradley should have been "fired" on that occasion. Of course, the inscription should have read, "Fire, Bradley, when you are ready."

One other point on this subject. The question often arises in the mind of the compositor as to which side of the punctuation mark he should place the quotation marks. The best rule I can give for his guidance is this: When only part of the sentence is quoted, the final quotation marks should precede the punctuation mark; but if the whole sentence is quoted, the final quotation marks should follow the punctuation mark. For instance:

Did you mean it when you said "He is a brute"?
And he said, "Why do you ask me this question?"

The question to be decided is, do the punctuation marks apply to the whole sentence or to only so much of it as is quoted? The above applies where the punctuation marks are either the colon, semicolon, exclamation point, or interrogation point; but it does not apply to the period and comma, which in all cases should precede the final quotation marks.

LENGTH OF LINES IN HEADINGS

Do not feel obliged to fill out the first line and turn over only a small part of the heading, as:

but rather divide it as follows:

AMERICAN AND ENGLISH SPELLING

The difference between American and English spelling is not great, and is mainly in such words as

honor, *favor*, etc. The English custom is to spell these words with the *u*, as *honour*, *favour*, etc. An Englishman once told me that an *honor* would not be an *honour* to him without the *u*. The American *ize* becomes *ise* in English spelling.

It is a rather interesting fact that Americans are apparently not at all sensitive about these differences, and will generally accept either spelling; but the English people are, and few English publishers will accept American books unless they are printed with the English spelling. So it is often necessary to go through a set of American plates and change them accordingly for the English market.

Now, boys, in closing I want to give you a little heart-to-heart talk.

Just in proportion as you put your earnest and best efforts into your work, just so far will you meet with success. Remember there is always plenty of room at the top; and remember, also, that you are the natural successors of the employing printers of to-day, and that if you will work faithfully and perfect yourself in the branch of business you elect to follow, you are bound to succeed and prosper.

Theories alone will not help you, but a superior knowledge of, and application to, your trade will land you in the best positions. Never in the history of the world has there been so good an opportunity as now to realize on merit.

Now is the time to decide whether you will neglect your opportunities and be one atom in a cloud of dust blown hither and thither by the breath of circumstance, — sometimes called "the army of the unemployed,"— or whether you will be *a master of*

your trade, and thereby the "master of your own destiny"— self-respecting, independent, and always in demand.

III

HOW TYPE IS MADE

HOW TYPE IS MADE

By J. W. PHINNEY, *Manager American Type Founders Co., Boston* :: :: :: LECTURE NO. III

Owing to another engagement, Mr. Phinney could not be present on the date of the third lecture, and his paper upon the subject was read by Mr. Geo. H. Ellis. The following is a brief summary.

IT was probably at Mentz that the invention of movable types was made, and without doubt Gutenburg was the inventor. The early printers were not only printers and binders, but also type founders. They took for their models the styles of the best manuscripts of the period, and the work of Gutenburg and his assistant Schœffer has never been excelled. It was only under great difficulties that they worked, yet it is almost impossible for one to tell the printed books from the manuscript.

Black letter was the first face that was cut, of which the German type is the direct descendant. It was Jensen that first made a success of the Roman letter which is now used everywhere except in Germany. Some of the type founders who have left their impress upon type fashions are Van Dyke, Elzevir, and the English founder, Caslon. Benjamin Franklin was the first type founder in America.

Following this brief history of type founding was an outline of the process of putting a new type face upon the market. It is first designed by the artist, and after the drawings are accepted they are sent to the matrix-maker, who makes reproductions of the face sunk in bars of hard metal; these matrices are then placed in a mould and the types are cast.

It seems a simple process, but it is exactly the reverse, for great care must be taken, experiments

made, fonts cast—perhaps to be thrown away and a fresh start made. The expense of cutting and adjusting the different sizes of a new face of type is sometimes $10,000. The type foundries are willing to spend large sums of money to produce satisfactory results, not only in their type faces but also in their specimen books. One of the foundries spent $70,000 on one of their specimen books.

A peculiar thing about type founding is that there have been no radical improvements made in type-casting, although improved machinery has been invented, so that greater speed can be obtained in casting; yet the mould has remained practically the same, and the casting, though now done by machinery, yet follows the old hand principle.

Mr. Phinney urged the preservation of type founders' specimen books as representing a vast amount of care and expense in preparation and making, and of great value in showing the growth and development of the printing and type founding arts. The American Type Founders Company, he said, has completed a fireproof apartment in its foundry at Jersey City as a typographical museum for the preservation of old specimen books of type, and also typographical books exemplifying the art and growth of printing and type founding.

At the close of the reading of Mr. Phinney's paper, Mr. Geo. C. Creighton, foreman of the matrix department of the Boston foundry of the American Type Founders Company, gave an informal talk on the mechanical operations of modern type-making. He exhibited a number of moulds and matrices of different styles, together with casts made therefrom, demonstrating the adjustments of the different parts and the operations of casting. The following are some of the points explained by Mr. Creighton.

THERE are two chief things required to cast a type — a mould, in which the body is cast; and a matrix, which faces one side of the mould and has in it a depressed image of the letter to be cast. The mould is made in two movable sections, which are fitted together in such a manner as to close up before the cast is made and open sufficiently to release the type after casting. It is made of the finest steel and requires the attention of skilled workmen in its construction. Owing to the high temperature to which it is subjected, every piece of steel (a complete mould usually is made of twelve or fifteen separate pieces) must be carefully hardened and tempered, and allowance must be made for expansion and contraction of its parts in such a manner as not to affect in the slightest the accuracy of the type which is cast in it. Accuracy in every part is vitally important. Each piece is carefully ground to a velvety smoothness and the parts of each section fastened solidly by means of steel screws. The weight of a mould varies from one to three pounds, according to the size of type to be made in it.

The matrix covers an opening on one side of the mould, and on the opposite side (which is the foot of the type) is an opening through which the melted metal is injected. To insure a solid body and clear, sharp face, this opening, or jet-hole, must be in right proportion to the size of the type to be cast.

A type mould is made for a single size of body, but is made adjustable sideways to correspond to the different widths of letters of a font. One mould may be used to cast all the characters of a font, or of any number of fonts of the same size body, by simply changing matrices for the faces. Each mould must be not only true for the type-body it is to cast, but it must agree exactly with every other mould for the same size of body, because, in a large foundry, a number of moulds may be used for casting the same size of type.

MATRICES MADE BY DIFFERENT METHODS

As the matrix is the pattern of the type-face to be cast, it will be seen that this is the really important operation in modern type-founding. Type-faces are many, and every week new ones are appearing. With the production of each new letter or character a new matrix is required, and with the every-day use of those styles in popular demand many are injured or destroyed and must be renewed.

Matrices are made by three different methods. The older method is by first cutting the letter on the end of a small bar of soft steel, which, when the letter has been perfected, is hardened, and is then used to stamp into an oblong plate of copper. This piece of copper, with brightly burnished surface, is held firmly in a block, and the steel punch driven into it with great force. This "strike," as it is called, is the matrix in the rough. When it is smoothed down on its face (which is now more or less uneven and out of shape around the sunken impression), with its sides trued up and finished, it is ready to be placed in the mould. This method of making matrices has

been the one commonly employed for standard faces of body type and faces in large demand, as, after the steel punch is made, it is the quickest way of producing a matrix.

The electrotype method consists, first, in securing a perfect pattern of the letter. This pattern may be engraved by hand or by mechanical means, or it may be a perfect type-face already cast. A brass plate (1½ to 2½ inches long, ¼ to 1½ inches wide, and ¼ inch thick) with a square hole near one end, is then provided, and the pattern letter so fitted in this opening that it will have some open space around its face. A number of these brass plates, with their pattern letters, are then arranged and fastened side by side in a "flask." This flask is next entirely covered with wax, except at the square openings in the brass plates. These openings, containing the faces of the pattern letters, are thus exposed, and the flask is then hung on a rod in an electro battery. Here the copper, held in solution in minute particles, is deposited on the exposed portions of the flask until it forms a thick shell and fills up the spaces between the sides of the square and the pattern. In a few days (often weeks, according to the size of the matrix), the flask is taken out, the wax removed and the pattern letter withdrawn from its copper bed, leaving a perfect image in copper securely fitted in the brass plate. This brass plate is now an unfinished matrix, and requires to be smoothed off on all sides, reinforced by another brass strip riveted on its back, and finally fitted for the mould.

The third method of making a matrix is with a wonderful modern matrix-cutting machine, invented by Mr. L. B. Benton and used exclusively by the

American Type Founders Company. In the upper part of this machine is placed a bar of metal composition — the future matrix. Above this, pointing downward at the proper position, is a rapidly-revolving hardened steel needle which cuts the design in the matrix. The cutting needle is held in the center of a finely-adjusted, movable steel frame. This frame, with its revolving needle-point, is controlled in all its motions, horizontally and laterally, by a rod suspended below; by moving the lower end of this rod with the hand over a given diagram all its motions are duplicated on a much smaller scale by the cutting needle above. It will thus be seen that the thing necessary to produce any design in a matrix is a pattern to be placed on the lower shelf of the machine, under the point of the suspended rod.

This pattern, however, must be specially prepared. The design is drawn in outline in a form enlarged to nearly six inches. This outline drawing is then placed on a pantagraph machine in which is a sheet of metal covered with a film of wax, and the outline is cut in the wax with a sharp point. This wax plate is then used as a mould from which an electro is made, producing an electroplate with the outline of the design in high relief. When this pattern is placed in the cutting machne a small hardened steel disc on the bottom of the tracing rod is guided between the raised outlines, the result being a miniature cutting of the pattern in the composition bar above — the matrix. One pattern may be used to cut matrices for several different sizes of the same letter by simply adjusting the machine to the size desired. All these operations in producing a matrix are mechanical, and may be done quickly and economically.

There are several things about a matrix which require skill and accuracy on the part of expert workmen. The outer surface must be in exact parallel with the face of the sunken letter, so that the face may be absolutely level on the top of the type-body. All the matrices of a font, and of all fonts cast in the same mould, must be of the same depth from the surface to the sunken face. Each matrix must be fitted so that it leaves the face standing exactly upright, with proper shoulder on each side, and on a true line with all other letters in the font.

When it is understood that the matrix-fitter, as well as the mould-maker, divides an inch into ten thousand parts and uses delicate measuring instruments which detect the difference between one of these parts and two of them, it may be realized what painstaking precision and minute calculation are necessary to produce a finished matrix.

CASTING MACHINES

The matrix and mould being completed, they are then attached to the casting machine. The casting machine consists, primarily, of a pot, in which the type metal is kept heated to a fluid state over a small gas furnace. Above and in the center of this metal pot is a rod with a spring attachment which at each operation of the machine acts as a plunger to force a small stream of hot metal through a side aperture into the jet-hole of the mould. After the casting, the two parts of the mould separate slightly, the matrix is drawn away from the face of the type, and the cast is moved out; then the mould and matrix close together again and the operation is repeated. Cold water or air is circulated near the mould to keep an

even temperature and prevent overheating. The matrix for one character only is placed in the machine and when enough types have been cast, it is taken out and replaced by another, the change usually requiring but a few moments.

There are several kinds of type-casting machines in use, such as hand, steam, and automatic. The older of these machines is the hand caster, which is operated by a small wheel with a handle attached. This is now used for small fonts of large types, and for casting sorts. Large type cannot be cast as fast as small sizes; the mould must remain closed longer for the metal to cool, it must open wider to eject the cast, and the whole operation generally is more deliberate.

Steam casters are operated by mechanical power (originally steam power, thus called steam casters) and, being faster, are used for casting smaller sizes of type in large quantities, such as roman faces for body type, etc.

When type is cast by the hand machines it is still unfinished, as the piece of metal called the jet, which cooled in the opening of the mould, still adheres to the bottom of each type. This jet is broken off by hand, the types are set in long lines, and fastened in a grooved channel, face down. A small plane smooths away the irregular surface caused by breaking the jet, leaving a shallow groove on the bottom of each type and allowing it to set on its feet. The types also have slight burrs and sharp edges of metal which must be rubbed off before they are ready for inspection and the font-room. Type cast on the older styles of steam machines also required the jet to be broken off afterward; on the later machines this was done by a little

device on the machine, though the final finishing of the type is done afterward by other operations.

Kerned types, or those which have parts of the face overhanging the body, like some italics, scripts, etc., must be finished by a special method.

These operations, when type comes from machines of the kind just described, are done mostly by hand, with the aid of a polishing stone or a small dressing wheel.

On the automatic casting machine, which is the modern method of casting type, the breaking of the jet, rubbing, dressing, etc., are all accomplished automatically on the machine, the types coming out in a continuous line practically ready for the compositor's case. A clear understanding of the operation of these machines, together with the many scientific and technical problems in the making of type, can only be learned by a visit to the foundry,

Types are cast one at a time, but they may be cast quickly; sizes of six-point or eight-point are cast at the rate of one hundred in a minute on these modern machines. The larger the type the slower it must be cast.

The height of type in this country is—well, about an inch—but strictly it is .918 of an inch. You who are pressmen and have to make ready a form on the press know how necessary it is for the type-founder to adhere strictly to the standard of height. Some one has asked how or why this height was fixed for a standard. I have heard the story told that many years ago a number of English type-founders were in consultation to agree upon a height for type, so that printers, having the product of any of their foundries, could use the types together in printing. They came

to a practical agreement that the height should be that of the English shilling — or eleven twelfths of an English inch. As the first fonts of type used in this country came from England, our first American type founders naturally made theirs the same height as those already in use.

The composition of type metal is a mixture of lead, tin, antimony, with sometimes a small addition of copper. Lead forms the chief part of all type metal. It melts and fuses easily with other metals, casts with a smooth surface in all parts of the mould, and shrinks very little in cooling; but lead alone is too soft for the service required of printing type. Antimony is put in to give hardness, and tin is added to give toughness. Tin also serves to solder the other metals. A small quantity of copper is added to give still greater toughness. Other metals have at times been used, but with little success. The type metal used for smaller sizes is much harder than that used for larger sizes, the softness gradually increasing with the size of type. Scripts and faces with delicate lines are usually cast with metal slightly harder than that used for normal or heavy faces.

SPECIAL MOULDS, ETC.

You will often see large metal types cast with hollow spaces, or cores, through the body from side to side. One advantage of this is to reduce the weight of very large pieces of type metal. So long as the face of the type is perfect and it is properly supported to give a solid impression, any excess metal may well be saved. Also, the smaller the quantity of metal required to fill the mould, provided there is no undue obstruction to inject it, the smoother and more solid

the cast will be. Types of this kind are cast in special moulds, the particular feature of which is one or two polished rods fitted to slide through one side of the mould and project into the interior. When the mould is closed and the rods pushed in, the liquid metal is cast and allowed to remain till it hardens; then the rods are withdrawn, after which the mould is opened and the type ejected as from the ordinary type mould.

Types mortised on the sides or on the corners may be cast in the ordinary style of mould which has a piece of steel fitted to the corresponding part of the interior.

Types that have mortises cast in the middle, such as hollow ornaments for initial letters, etc., are cast in ordinary square moulds, but with matrices which have attached to their face a piece of steel corresponding to the size of the mortise.

Other devices in moulds and special matrices are frequently required to meet demands of modern type founding—and all this, you will understand, that the type founders may set before the modern printer fresh designs and economical utilities for the prosecution of his work.

IV
MACHINE COMPOSITION

MACHINE COMPOSITION

The Linotype, by J. D. MONTROSS. : : *The Lanston Monotype, by* ROBT. W. SWIFT : : LECTURE NO. IV

I AM not going to make any apologies for reading my so-called "talk" from manuscript. I have two good reasons for doing it. Having written it, I can now talk faster, so you will get more for your money; again, I want to cover my topic, as some of you, I hope all, may want to write for one or all of the prizes, and if I depended on my memory I might stray from my subject, — the Linotype.

While I wish to devote most of the time allotted to me in telling of the Linotype, perhaps a few minutes spent with you on the historical part of the general subject of type-setting machines will be interesting as well as instructive.

You are all more or less familiar with the printing business; you know what type is — I know you have heard here what it is, how it is made, and what it means to use it.

HISTORICAL REVIEW

During a period of some four hundred years — that is, from the time that movable type was first used until the first patent for a type-setting machine was filed — there is no telling how many minds conceived the idea that the drudgery of setting type by hand might be relieved, or entirely done away, by machinery; the very fact that a patent was filed shows that at least one person had the matter in mind, and little did he or they realize that they were struggling with a problem that would be commercially unsolved at this late day. The object then was to make a commercial machine that would set

foundry-type, justify the lines and automatically distribute it. Be that as it may (and here's another one for Boston), Dr. William Church of this city was the first to file letters patent for a type-setting machine. The patent was filed in England in 1822. The machine consisted of a large wooden frame in which was arranged channels containing type. A key-board was connected with the channels. On touching a key-button a type was ejected onto a plate where it was dropped into a tube. The type was removed from this tube and justified into lines by hand. Distribution was by hand. The only power used was a clock mechanism.

You see, from the first there was little difficulty in *setting* — the problem of justifying the lines and distributing the type was yet to be solved.

For twenty years little progress was made; but early in the 1840's Young and Dalcambre, also Clay and Rosenberg, each brought out a machine. Both were decided improvements on Dr. Church's machine; indeed, Clay and Rosenberg's machine had a distributor. It worked just the reverse of the compositor — the operator would read the line and then spell it out on the key-board. A pressure device, actuated by weights, pushed the lines forward.

From this time on, every year or two saw a new composing machine. A Mr. Gaubert, an Englishman, in the early 40's conceived the idea of distributing type by means of special nicks; and about ten years later, Mr. Sorenson, a Swede, brought out a machine which included this scheme of distribution. The machine consisted of two cylinders, one above the other. The upper cylinder rotated and contained in channels the type to be distributed; when the nicks

in the type matched the combinations at the entrance of the channel to the lower cylinder it would fall into the proper channel. This machine was very similar to the machine invented by Joseph Thorne and patented in 1880, which is still in use and sold today under the name of the Simplex.

The first United States patent on a composing machine was granted to W. H. Mitchell of Brooklyn, N. Y., in 1853. Mr. Mitchell's machine had a distributor as well as a composing machine, and although a number were used commercially they were not really successful. During the next twenty years many composing machines were patented here and abroad, but none was good enough to be put into general use. The year 1872 seems to have been the turning point. In that year the Burr machine was brought out. It was the most satisfactory machine produced up to this time and actually went into printing offices for commercial use. There are some of them in use to-day. The name of the machine was afterwards changed to the Empire, the name by which it is now known. This machine consists of three cases, each containing twenty-eight channels of type. Back of the foot of each channel is a steel pusher; when the key button is depressed the bottom type is pushed forward and assembled until a line is formed; the line is then justified by hand, usually by a second operator. A very neat and convenient arrangement for spacing is provided. The spaces are stored in channels; the operator has only to pinch the thumb pieces at the end of the channel containing the desired space, when the space in between his fingers.

The machine has an excellent distributor; a galley of dead matter is placed in the machine and a line

at a time is lifted and passed along a series of feelers; the type, being specially nicked, is placed by the feelers in its proper channel.

The year 1872 brought more, for in that year James W. Paige began experimenting on what proved to be the most ingenious and marvelous type-setting machine ever invented. I am always so impressed with this machine that I will squander a moment or two of the Linotype's time in telling you of it. By the way, this was the machine that Mark Twain "backed" to the extent of $265,000 and he doesn't see the joke yet. It took fifteen years of experimenting, or until 1887, to build a complete machine. Five or six years later a second machine was built, then re-built, then after some $2,000,000 had been spent, everything was sold to the Linotype Company for a mere song. But the machine — it was nine feet long, weighed over three tons, and contained some 18,000 parts. The keyboard, containing 109 characters, was the result of ten years of faithful study. It was so arranged that combinations of letters and syllables most frequently used could be struck simultaneously; thus whole words could be assembled by one stroke of the hand. An operator with a few weeks training could set up 10,000 ems an hour; what the capacity of the machine would have been in the hands of an expert is hard to tell — perhaps 20,000 ems or so an hour. The scheme of the machine was to set foundry type, justify, and afterwards distribute it. You may recall I mentioned in the beginning that these three things were necessary to make a type-setting machine that could be commercially successful. All the operator had to do was to manipulate the keyboard. At the end of each word a space key was struck — at

the end of each line a line key was struck; the operator went right on setting up the next line. The machine measured each word and passed the line to the justifier, where the proper spaces to justify the line were inserted and the line passed along to a receiving galley. All this time, in as cool a manner as you please the machine was automatically doing the most remarkable distributing stunt you can imagine. Up to three galleys of dead matter could be placed in the machine at a time; line by line it was forwarded to a testing device and every defective type discarded. Next, another device removed any turned or inverted type; this device also removed any sorts which were not in the keyboard, such as accents, special characters, etc. The type that stood inspection — wasn't worn, battered, nicked or less than type high—was put into its proper channel, the spaces going to their respective places. This distributor had no respect for the old adage that cleanliness is next to godliness, for it went right along distributing whether the type was clean or dirty, wet or dry. When any channel was full, it just stopped distributing into that channel. I nearly forgot — that nothing desired might be left undone, the machine measured the type set and a glance at the dial at any time would tell the amount set. Why wasn't it a success? Because to keep it running required an amount of mechanical brains and skill seldom found in human beings.

In 1880, Joseph Thorne brought out the Thorne machine, now known as the Simplex. I have mentioned this machine before. It is one of the machines now upon the American market. It sets and in the same machine distributes specially nicked foundry type. Justification is accomplished by hand.

Subsequent to 1880 a number of machines were patented. Among them are the Wicks composing machine, the Macmillan, the Dow, the Cox, the Converse, the Rogers Typograph, and many others. As they have not come into general use, nor have they marked an epoch in this history, I will pass them with this mere mention.

ORIGIN OF THE LINOTYPE

Leaving the historical part, we come to the Linotype and the Monotype. As the features and virtues of this latter machine will be ably presented to you presently, I will attempt to tell you of the Linotype: what it is, what it does, and how it does it.

First, it isn't the Lin-o-type, but the Line-o-type. Second, it isn't a typesetting machine, but rather a composing machine furnishing a complete substitute for single types; in doing this it makes each line, of the desired length, in one piece called a slug.

A number of stenographers, mostly court stenographers, had obtained a crude model of a machine, which, if it could be perfected would save the operation of reducing their notes to writing and then having them printed. The idea was to produce a printing surface at the first operation. A Mr. Mergenthaler, a watchmaker by trade, was recommended to them, and he was employed to carry on experiments. After trying about every possible way, and about every known material, to get a direct transfer process, he gave it up. You can readily see how a mind centered on one thing day in and day out would sooner or later develop something; so it is not surprising that he conceived the notion of assembling a line of dies or matrices and casting molten metal against them,

thus forming a complete line of type in one piece or slug. In the original machine the character on the dies (I shall hereafter refer to them as matrices) were stamped or punched in the edges of long bars, each bar containing the entire alphabet. The keyboard controlled the matrices and stopped them at the required letter. In the next machine built, small matrices with but one character on the edge of each were tried and met with instant success. You who are familiar with the Linotype of to-day would scarcely recognize that machine. The channels containing the matrices stood bolt upright and on arriving at the assembling level the matrices were violently blown into the assembler. A number of these so-called "blowers" were built and used in newspaper offices. Shortly after this the present scheme of assembling the matrices was adopted. The magazine containing the matrices was placed in an inclined position, the matrices falling by gravity and carried forward to the assembling point on a carrier belt.

FUNDAMENTAL MECHANISM

The Linotype consists of a number of brass matrices having the characters of the alphabet, figures, etc., stamped on their edges; these are held in a magazine where they are controlled from the keyboard.

The operation of the keyboard assembles the line desired, a wedge space-band being placed between the words. When the line is completed a bell rings, and by simply depressing a lever the line is automatically presented before the mould behind which is a pot containing molten metal. The wedge spaces are automatically forced upward as far as they will go, thus justifying the line; as the line is justified a

plunger descends into the metal pot, forcing a quantity of metal to flow forward into the mould and against the line of matrices which has been presented to the mould. Thus a slug is formed in the mould; on the top of this slug are the characters which were contained in the line of matrices.

The metal pot recedes, as does the mould; as the mould recedes, the disc containing it starts to revolve and, as it does so, it passes a knife set at the back of the disc which cuts off or trims any burr or extra metal which may be on the foot of the slug; thus making certain that every slug will be type high. Having partly completed its revolution, the disc stops, the mould containing the slug then being in a vertical position; an ejector blade then comes forward and pushes the slug out of the mould between two trimming knives into the receiving galley. As the slug is pushed between these knives it is accurately trimmed on its sides, assuring a slug of the exact body desired. While this operation is taking place, an elevator descends from the top of the machine and raises the matrices to the distributing mechanism. Here the matrices are carried along by revolving screws and each distributed into its proper channel to be used again in its turn. As the matrices are lifted, the wedge spaces are left behind and pushed back to their place to be used again. By the fortunate arrangement of the machine, three lines can be kept moving at once — one being assembled, one at the casting point, and the third being distributed. The magazine will hold twenty of each letter, enough for all ordinary purposes, to keep the three lines going.

Thus you see that the sole work of the operator is to manipulate the keyboard, and when a line is

completed he simply depresses a lever and immediately starts to set another line, every other part of the entire operation being automatic.

FLEXIBILITY OF THE LINOTYPE

In the early machines the mould which forms the slug was flexible only as to the length of line. If a change of body was desired, a mould to cast that body would have to be placed in the disc; this naturally consumed time, something that cannot be wasted in the print-shop of to-day. After a series of experiments the present mould was placed upon the market. This mould is adjustable both as to measure and body. To change the measure, it is only necessary to change the filling piece or liner in the left end of the mould; where a larger slug is required, a shorter liner is placed in the mould and a larger liner for a shorter slug. To change both body and measure, the liner on each end is changed; thus to change from one body and measure to another is a mere matter of seconds.

Also in the early machines each matrix had but one character stamped in its edge, so, if an italic word was required, it had to be set into the line by hand. The fact that only roman faces could be conveniently set on the machine did one good thing, if it never did another — it rid our newspapers of a large amount of italic emphasis, a mighty weak emphasis at the best. This was all well enough for the newspapers, but it did not meet conditions in the book office. This led to the inventing of the two-letter attachment. Two letters are punched in each matrix, one above the other, and by a simple arrangement of rails in the assembler, which are controlled by a finger key, the matrices are assembled at the desired

level. Thus, if an italic word is to be put into a line the words in roman are assembled in the usual way; when the operator comes to the italic word he pulls the finger key and, until he presses it back again, all matrices will be assembled at a higher level. Having set the italic word, he presses the key back and finishes the line; it goes forward to the mould with all but the italic word in the usual position; this one word is higher; in other words, it presents the lower or italic characters on the matrices to the mould. Fonts are now made so that, in place of the italic, black faces can be set in conjunction with roman in the same manner as I have just described.

From the first it has been possible to change from one size of type to another. This is accomplished by removing the magazine which holds the matrices and putting in its place another magazine containing matrices of a different size. The early machines would set from five to eleven point. The present machines will set from five to fourteen point. There have been a number of changes in late years in the method of changing the magazines. In the early machines quite a little mechanism had to be removed with the magazine. Later this was greatly simplified, although the magazine had still to be removed from the rear of the machines and, on account of its weight and inaccessibility, required the services of two men. In our present machines all mechanism connected with the magazine remains in the machine; it has been materially lightened and is removed by lifting it from the front over the keyboard. One person can now readily make the change in less than a minute.

DOUBLE-MAGAZINE MACHINES

In this long course of development and our experience with many offices, it became evident that to cover certain classes of work a machine carrying more than two faces would be required. To cover this field the double-magazine Linotype was placed upon the market. While this machine is upon the same lines as the usual Linotype, it contains two magazines, one overlying the other, each of which may contain a font of two-letter matrices. From five to fourteen point can be carried in either magazine, so that you could have matrices of the same size in both magazines, or five-point in one and fourteen-point in the other.

If the operator is setting from the upper magazine and requires matrices from the lower, he simply lowers a lever; to get matrices from the upper again, it is only necessary to raise the lever. The casting mechanism is identical with that of the usual Linotype. Two moulds are placed in the disc, so in case the matrices are of a different size, a quick change of body can be made. This is done by the operator without leaving his seat, it being only necessary for him to pull a cluch and turn the disc partly around. In distributing, the matrices are lifted to the distributors in the usual manner, the matrices belonging in the lower magazine dropping through a shute to the lower bars, there being two separate distributors on this machine. The development of the double-magazine machine has been rapid. In the first machines the lower magazine was stationary and could not be removed. To change the face it was necessary to run all of the matrices out by means of the key-board

and then put another font in, a few at a time, through the distributors. This wasn't the only feature to be overcome: the speed obtained from the lower magazine was much less than that from the upper; it had been our idea that the lower magazine would be used only as an auxiliary to the upper. You have before you a cut of the latest double-magazine Linotype. Not only can both magazines be changed, but each can be changed in less than a minute; indeed, the lower magazine can be changed while the operator continues to set from the upper magazine. The same speed can now be obtained from both magazines.

ADAPTED FOR GOOD WORK

In late years the machines have been developed along lines which would fit them for the finer grades of printing and to-day, if the machine is properly and regularly cleaned and intelligently cared for, it will give a product that is fully equal to new foundry type. There is no class of composition under fourteen-point that the machine will not do, and do it at a large saving in cost over hand work.

Until recently the machine would not set a wider measure than thirty ems pica; we can now furnish machines that will set as wide a measure as thirty-six and one-half ems pica. There are twelve of this type of machine in the Government Printing Office at Washington to-day.

When I say the Linotype will do all classes of composition, I mean it. But a short time ago Mr. John R. Rogers, the inventor of the Typograph, invented a tabular attachment which can readily be applied to all machines. The mold used is not as high as the usual mold and the character, instead of

being stamped in the edge of the matrix, is stamped in a recess cut in the matrix; this recess is about a quarter of an inch deep; thus the matrix is made a part of the mold, that is, the metal goes into the recess in the matrix; wherever a rule is to appear a thin blank matrix without any recess in it is placed in the line, so when the line is cast this thin plate leaves a slot in the slug; when the column is completed, these slots form a continuous slot into which shallow rule can readily be inserted. Table work should be proved and corrected before the rule is inserted.

As to Linotype corrections — there never has been any doubt that corrections could be made more speedily on the machine than by hand, as the machine is capable of making six new slugs a minute, but, with the usual perversity of things, when you wanted to make a few eight-point corrections, ten-point was in the machine and it took two men from five to ten minutes, depending upon their skill, to make the change; with but a few corrections to make, the machine lost out; but this was not so where any amount of matter was to be corrected. With the new Linotype the change from eight to ten points can be made in a minute. Let us suppose we have three galleys of matter to be corrected and there are twenty lines in each to be corrected; instead of six, we will say that the operator casts five corrected slugs a minute; this would take him twelve minutes to make the sixty corrections; if a change had to be made to get the right size or font, it would consume a minute each way — we'll say fifteen minutes; this is the amount of time the machine has ceased production and the corrected lines are ready and justified. How long do you fig-

ure it would take by hand to make sixty corrections and properly justify the lines?

A moment or two ago I said that the finest grades of printing could be produced from Linotype slugs, and yet I see much printing from slugs that we cannot be proud of. It is not caused by any inherent defect in the machine but solely by the ignorance, carelessness or indolence (I could use a worse expression) of the attendant. We frequently see burs or hair lines between the letters; this is caused by the breaking down of the thin side walls on each side of the letter, and probably without exception the walls are broken down by metal which has been allowed to accumulate on the wedge spaces. These spaces should be cleaned every day by simply rubbing them on a board covered with canvas.

Again, we see slugs that are literally full of holes; the metal itself has been bad, too hot, or dross and dirt has been allowed to collect behind the mouthpiece through which the metal is forced into the mold.

A bad or sandy face is usually caused by the metal being poor, or it has been suddenly chilled. It is an every-day occurrence to see two or three cold ingots thrust into the pot at once, when one only should be put in, and operating is immediately resumed.

If slugs are off their feet, it is because the side trimming knives through which the slug is pushed into the galley are not properly set. If every slug, whether it is cast to-day or a year from to-day, is not exactly type high, it is because the trimming knife back of the mold is not properly set.

Taking into account the degree of accuracy required to produce a perfect printing surface, the Linotype in its present improved state is about as fool-proof as a sewing machine.

Lecture IV—MACHINE COMPOSITION

IN the unavoidable absence of Mr. Hays, who had expected the pleasure of addressing you this afternoon, this pleasant duty has devolved upon me, and I shall attempt in the brief time at my command to outline to you the history and development of the Monotype, its mechanism, flexibility, and product.

Since the days of Faust and Gutenberg it has been the dream of the printer to accomplish mechanically that which for centuries had been done by the slow and laborious method of selecting the individual types from the cases and assembling them by hand in the composing stick. The efforts in the direction of invention have been slow and difficult; and inventors have flooded the market with impracticable machines, though many of them imparted principles of value, and were leading in the direction of solving the problem.

The types were first cast in hand moulds; this process was followed by the automatic machines now used by the foundries, enabling the printer to get, at a reasonable cost, perfect individual types. The difficulties of composition were still to be overcome and as a natural sequence machines were invented which would automatically assemble and distribute this foundry product. These methods, however, never met with unqualified success, due in a great measure to the fact that the product, which was perishable, must still be purchased from the type foundry. The breaking and wearing of the type and constant requirement for sorts and the wearing of the face still loomed up before the printer as his great bugbear and profit-eater in the form of type foundry bills.

Then came the slug machine which to a degree solved this problem in the smaller sizes of body type,

giving the necessary increase in speed and eliminating distribution on sizes from fourteen-point down, and giving the newspapers the opportunity to achieve the remarkable feats of present-day journalism with the enormous editions and facilities for getting out telegraphic news.

The natural sequence of the progress of invention finally resulted in the production of the Monotype, a machine which would produce individual types and assemble them in perfectly justified lines with a speed and economy infinitely greater than hand composition and still maintain the quality of the production, as well as give enormous advantage for corrections and manipulation that the individual type must ever maintain over every other method.

First, I wish to explain briefly the principles of the Monotype system; that is, the system by which the work is produced, and the manner in which the casting machine or type making is separated from the key-board or composing mechanism. I will briefly give you, therefore, a description of the key-board and caster, and the relation of one to the other.

THE KEY-BOARD

The key-board, which is in appearance and operation very similar to the typewriter, is entirely separate from the casting machine. Striking a key on the key-board, however, instead of producing a letter, as is the case in the typewriter, punches a tiny hole in a paper ribbon, which is automatically fed over a series of punches provided for this purpose. This perforated ribbon, which in appearance is not unlike the music roll of a pianola, is transferred, when the take is completed, to the casting machine.

Here each perforation in turn is automatically presented to a corresponding air tube on the casting machine, admitting compressed air and controlling in turn the mechanism of the caster and producing exactly the character and composition previously determined by the key-board operator.

At each of the 140 revolutions per minute of the caster, a new hole in the ribbon is presented to its proper air tube, and a perfect and standard type is automatically produced, the whole assembled in perfectly justified lines and placed in the galley.

Thus the key-board, being separate from the caster, makes it possible to have the key-board and caster together, as is necessary in small one-machine plants, where a machinist operator is employed; or it makes possible the division of labor, recognized as so vitally important to obtain large and perfect production in modern manufacturing. Thus the key-board operators, removed from the fumes, grease and mechanism, can give their undivided attention to speed and accuracy of composition; and the caster man in turn can give his undivided attention to the casting for the production of perfect and accurate type, thus each man does what his talent and training best fit him for.

In addition to the two rows of red keys at the top, which are used purely in connection with the justifying system, the key-board has 225 keys, representing as many characters. These are arranged in fifteen rows, each row containing a group of fifteen characters which bears a fixed relation in size to each of the other fourteen rows; that is, for instance, on the fifth, sixth and seventh vertical rows will be found the figures and all characters requiring a nut body,

while in the fifteenth row will be found the characters requiring the "mutton" body or quad. All characters are thus grouped in the rows which will give them their proper body sizes. The actual point size required does not in any way change the lay-out of the keys, but is determined by the mould on the casting machine, and merely requires a slight change on the counting or, to give it its proper name, justifying mechanism of the key-board.

This counting mechanism is placed just above the key-bank and consists of a graduated em scale and a pointer, which registers the amount set in each line, and the small cylinder, called the justifying scale, also provided with a pointer, which indicates to the operator which of the red keys in the upper row to touch in order to justify his line. When a key is depressed the pointer on the em scale registers the space taken up by the character represented by the key which the operator has touched. We can consider the keys as representing the cases, and the em scale as representing the stick. In hand work the compositor picks his type from the case, places it in the stick and repeats this process until the stick is full. The Monotype compositor, instead of picking out the character, depresses a key, and the em scale registers the exact amount of space taken up by the type to be used, the pointer moving along the scale the proper distance for each character and space, until a bell rings warning him that his line is complete. The hand compositor, at the end of the line, finds his line does not quite fill out the stick, and increases the size of the spaces between the words to justify the line. The Monotype operator, at the end of the line, merely looks at the pointer

against the small cylinder and touches two of the red keys in the top row indicated by the pointer. This automatically justifies the line by increasing the sizes of the spaces between the words to exactly fill out the line, and the operator accomplishes this without thought or effort on his part. It must be always borne in mind that the caster will eventually be compelled by the perforated ribbon to carry out automatically the previously determined effort of the key-board operator, all figuring on the justification having been done by the Monotype Company at the factory, when the machines were built, the em scale and the justifying scale, each provided with a pointer, being the automatic guides for the operator.

I will not go into details of the justifying mechanism, but call your attention to the fact that the justifying is done by the machine, by automatically increasing the sizes of the spaces between the words to meet the need of each line; and again, the size of each character being known makes it possible to justify by what might be called the self-spacing system, this latter method being largely employed in tabular work where there are a number of columns of figures and a given number of figures in each column. For instance, should a column be ten picas measure, and you are running twelve-point, by throwing in twenty figures on a nut-quad body (in this case touching a nut-body key twenty times) you know without further calculation that you have a ten-pica measure; and as I explained before that each row maintains a distinct relation in width to all the others, it is plain that this known system is a very simple and easy method of justification in tabular work.

The 225 keys admit of placing six alphabets at the command of the operator,—roman caps and lower case, italic caps and lower case, and bold face caps and lower case, or a great number of special characters can be substituted for a part of the regular lay-out; this is often necessary in mathematical, scientific, and encyclopædia composition, where signs and accents play such an important part, it being necessary merely to put these characters in the row of keys which will give them their proper body size. In all cases the lay-out of the copper matrices is made to conform with the arrangement of keys on the board. Add to this the fact that the Monotype will compose in any measure up to sixty picas and you can have an idea of the flexibility of its product.

THE CASTING MACHINE

For brevity in describing the casting machine we will divide it into its most important parts: the matrix from which the face is cast, the mould in which the body of the type is cast, and the pump which supplies the metal after the mould and matrix have been automatically brought in conjunction and injects the metal in a molten state with sufficient force to perfectly fill the mould. All these parts are, if required, under the complete control of the paper ribbon which was perforated by the operator at the key-board and which acts as the brains for the casting machine.

The matrix is a piece of hard copper one fifth of an inch square, in the lower end of which the character is driven. Two hundred and twenty-five of these (one for each of the keys previously described on the key-board) are similarly arranged in fifteen rows of fifteen

matrices each, and are held together in a steel frame by wires which pass through them.

By means of the mechanism on the casting machine the required matrices are moved one after the other over the opening in the mould, in the order previously determined by the key-board operator, and each is held there during the process of casting. A new matrix moves to the position over the opening in the mould at each of the 140 revolutions made by the casting machine in one minute, and the required character is produced.

The mould is a beautifully-made piece of machine work, composed of steel. It is rectangular in shape, and made to an accuracy of one ten-thousandth of an inch, and is built in such a way that the type is cast complete in the mould, no finishing or trimming being necessary afterwards. The feet and body of the type produced by the mould itself, insures the most perfect accuracy, as it is impossible to trim any piece of metal with the assistance of knives as accurately as it can be cast in a solid steel jacket of a water-cooled mould. The moment that the hot metal is injected into the mould it is cooled by an arrangement of water circulation, is at once ejected into the mechanical stick, and is automatically assembled in lines and placed on the galley ready for the proof press. The pump, at each revolution of the machine, injects into the bottom of the mould a sufficient amount of metal at high pressure to insure a perfect cast.

It must be borne in mind that in composition, which the machine will produce in sizes from five to fourteen point, caster and key-board are both needed, but the casting machine, in the mere production of type for the cases, is perfectly independent and can

produce sorts from five to thirty-six point at a conservative estimate of fifteen pounds an hour without requiring a keyboard. This is one of the most remarkable points of the Monotype, and its economy in saving of time and foundry bills as purely a sorts caster cannot be over-estimated. It will supply the office at request with any sorts or space material required without recourse to the type foundry or without the necessity of waiting, and this should strongly appeal to you men who are looking forward to some day managing your own office and getting rid of idle time. It eliminates you entirely from the foundry and makes the office possessing the Monotype a power in itself, and in a position to accept any work regardless of the amount of body and display type required for the job.

Were, therefore, the old printers to have specified the requirements for a mechanism which would make conditions ideal in printing, they would have required a machine embodying the following principles:

1. That its mode of operation should be so simple that the ordinary compositor should be able to master it easily, and turn his past experience and knowledge of typesetting to the most profitable account.

2. That intricate and tabular work should present to this machine no more difficulty than straight composition.

3. That its quality should equal the best foundry product and still have the advantage of a new printing surface for each job.

4. That the product should be as easily and freely handled as hand composition.

5. That the cost of the work, quality for quality, should be lower than that of matter handled by any other method.

6. And that display type for the cases should be made of the finest quality, and the lowest cost.

These are the essentials of the ideal machine and there is not one of these which the Monotype does not supply in every particular.

The majority of time tables and tariffs and railroad work done in this country are handled on the Monotype. In magazine composition where over-runs, due to the insertion of cuts, are frequent, the speed of Monotype straight composition and the ease with which the individual type is manipulated, has proved this method to be more economical than any other. And the number of editions-de-luxe printed from Monotype type attests to the high quality of the composition.

In the performance of its work the casting machine gives at first sight an idea of complication, as its moving parts occupy so little room and are grouped so that the observer sees the whole mechanism at once. This is unfortunate, as the saving of floor space and placing of moving parts in plain view are two of the strongest points of the machine.

The best proof that we have of the simplicity of the machine is the success that we have met in training operators at our school in Philadelphia. We have there a large battery of machines and a competent corps of instructors whose duty it is to teach men to take charge of the new plants which are being installed all over the country. We have found most of our best operators and machinists in the ranks of the printers, and eight to twelve weeks has enabled men, who have never seen the machine before, to take charge of a plant. We are anxious especially that printers avail themselves of this course and extend a hearty invita-

tion to any of the men here to put in their application. The education is brief but most thorough, and is absolutely free to any young men coming well recommended. The fact of his being a printer especially recommends him.

It is an interesting fact that a few years ago when the lack of general knowledge of the Monotype made it hard to get printers to take it up, we were compelled often to take men who had nothing to recommend them but character and intelligence, and whose previous training had nothing to do with the printing business or the machinist trade. The fact that many of these men are today high-paid Monotype machinists speaks very strongly for the simplicity of the Monotype and should encourage you young men, whose education as printers has particularly fitted you for this work, to make application for instruction, and I trust it may not be long before some of you will be knocking at the door of our school in Philadelphia, where you are already assured of a welcome hand.

V

FROM APPRENTICE TO EMPLOYER

FROM APPRENTICE TO EMPLOYER

By THOMAS TODD, *Proprietor of The Beacon Press, Boston* :: :: :: :: :: :: LECTURE NO. V

MY dear boys, I shall begin my feeble remarks with the old chestnut of the school teacher in Germany, who invariably, when the scholars came in the morning, would bow low to them; upon being inquired of as to his reason for doing so, he replied, "They may be burgomasters some day." And so, in like manner, I bow low before you who are apprentices; because by and by you may be among the master printers. You are not called upon to endure the tribulations that we old apprentices had to undergo. None of you, as yet, have had to get up two or three hours before daylight, and shiveringly go down to the office, build a fire, thaw out the rollers that are filled with frost, holding them up to the fire to get the frost out, yet needing to be very careful about approaching too near the fire, lest your rollers should melt. I doubt if one of you have ever had that experience. I know that none of you have ever had the experience of washing rollers in potash lye, when your hands were so chapped with the cold that the lye would get into the cracks in your hands, and you would suffer torture. I question if any of you ever saw forms put into a rocking trough, where the trough rocked on a pivot in the centre, where the kettle of lye was poured upon the form, and the trough rocked to and fro until the lye was thoroughly incorporated into the form; then the face of the type was scrubbed with a brush, then all the lye drawn off, and clear water substituted; the process of rocking the cradle again gone through with until the lye was supposed to be thoroughly washed out, and the form lifted from the

trough, put on the stone, and unlocked to distribute. When the form was unlocked, you could take a handful of type and throw it across the office before it would drop apart. O, the fingers of the apprentices! Scarred, and marred, and mutilated — worse even than the base ball players of today.

APPRENTICES OF THE PAST

We had an apprentice, or rather, I should say my father did, by the name of Joyce, who afterwards became a lieutenant in the United States Navy. No printing office could hold him very long. He was a dare-devil little fellow, and once for three cents he took off his boots and stockings and, taking a pail, walked quite a little way down to the town pump through the snow, drew a pail of water and brought it back to the office. He thought he had earned his three cents, and his fellow apprentices thought so, too. Again, upon being stumped, for three cents, he put his flaxen-haired head into an ink keg. His mistress (for all apprentices boarded with the master and mistress) simply went wild over the possibilities of her pillow cases, until his flaxen hair became once more restored to its natural color.

It was the province of my father, as the oldest apprentice, to thrash all the younger apprentices for misdemeanors. In thrashing this Joyce, the boy never whimpered, and all the reply he made to father's work was simply, "You damn nigger, you!"

The apprentices of those times were not so tenderly nurtured as the apprentices of the present time. One of our delectable enjoyments, as apprentices, was to roll the forms of the newspapers that we used to print, and it was no slight matter. The rollers

must be kept in first-rate order, ink must be put on by the brayer, and the handle of the cylinder turned to distribute the ink very rapidly, because when the form was presented before the rollers, the ink must be all distributed, and there must not be a second of time to hinder the working of the press. The pressman was obliged by the canons of the trade to print a white token (240 sheets) in an hour. He had to fly his frisket, take off his sheet, replace another, throw the frisket down, roll the tympan under the press, pull the lever, throw it back, roll his form back, lift his tympan, and fly his frisket for each impression. I have heard it said that with the old Ramage presses, where two impressions were taken of each form, the pressman attained the same speed of 240 impressions an hour. How he did it is more than I can understand. That was before my time.

NECESSITY OF BEING CIVIL

An apprentice in those times (I do not know how it is now) was obliged to keep a civil tongue in his head, else punishment, swift and dire, would fall upon him. An apprentice was once "sassy" to the pressman, who thereupon rolled his form under the platen, swung himself around behind the press, took the apprentice by the collar with his right hand, and with his left hand took the brayer from the ink table, and rolled the apprentice's face with ink. That occurred under my own knowledge, although I was not the victim, for I want it distinctly understood at *that* time I was not saucy. How far I may have attained proficiency in the art now, under the tuition of other master printers, it is not for me to say.

APPRENTICES' GRAFT

After the forms were printed on the press and the papers folded, then the apprentice had a route of papers to carry. If he served the patrons of the paper well, at New Year's time the editor would work off a lot of doggerel and call it poetry, the apprentice would set it up at odd times, and print it, and then on New Year's Day he would present to each patron a copy of the screed and receive in return either a fourpence-ha'-penny or a ninepence, and in some extreme cases, where the patron was very rich, a quarter of a dollar. That was about the only event in the life of the apprentice in those days that was joyously rememberable.

NEW IMPROVEMENTS IN PRESSES

Another little enjoyment of the apprentice, so different from what we have now, was to print wedding cards and other delicate stationery on a 24 x 36 hand press. By putting on bearers all over the bed of the press, he could arrange his impression very well. But even under these circumstances he could only draw the lever of the press around half way, or at some imaginable notch on the cross bar. Woe betide him if he forgot for a single impression and pulled the bar clear around. Then the foreman indulged in profanity, forcible and prolonged; for that font of type was entirely ruined. I have printed business cards on a double-medium hand press for $2.50 per thousand. It would take a day to do it, but then I was an apprentice and I was of no account. When a Yankee card press was invented, it was a godsend to the craft. It is an obsolete thing now. I doubt if one of you have ever seen one, unless perhaps one

may be in some museum; but it was a delicate little machine with rollers six inches long and one inch in diameter and a lever that stood upright above the press. The worker would take the lever in his left hand, with his right place the card in the gauge, then pull down the lever, thus making an impression, push back the lever, and the card would drop out, while a new card would be placed in by the right hand of the operator. It seemed to us perfectly marvelous, and as though nothing further need be desired in the printing trade. My wedding cards, fifty years ago, were printed on such a press.

NO LABOR UNIONS

We apprentices knew nothing of the nine-hour law, nor yet of the eight-hour rule that is expected to be about to occur soon; but we worked until we were told to go home. The night before publication day I have often worked until three o'clock in the morning, and the compliments I have received from the foreman and the hands for my faithfulness would be enough to satisfy even the most self-appreciative person; but next morning, after all had worked all night, the atmosphere in the office was entirely different. I was, in the language of the foreman, a damn little cuss. I was no longer a little hero.

TRICKS ON APPRENTICES

Such little pleasantries as sending the apprentice out to borrow roman bodkins, italic small caps, italic thin spaces, and such trifles, were delightful. Type lice were not invented then. One of the realities of life, and one considered necessary in those times, where sorts could not be bought, was to send one

apprentice over to interview the apprentice of another office, and borrow surreptitiously say a half dozen brevier capital M's, or some other types that were indispensable to complete some job on the press. They used to tell about a man named Moody, who used to do business in the city of Boston, that he would send to borrow a dozen of some particular letter, pica size; if the reply was made that they had no pica, but they had nonpareil, he would answer that that would do just as well; and when you saw the job issued from his printing office, you would understand why one would do just as well as the other.

When I was an apprentice there was a kind of combination border used, which had a solid line running through a mass of filagree, and by changing the solid lines, curves and hollows, lettering, names, business, and such horrible things could be traced through the border. If we were real good, the boss would let us set up our names in those combination borders and we would print them on bronze paper, with gold bronze, and show them to our admiring friends as a *chef d'œuvre* of art. But those were halcyon days.

RESPONSIBILITY EARLY IN LIFE

When I was twelve years old, my father had a printing office in a country town, having lost his fortune and started anew, and my father, my brother and myself were his whole force. My father was stricken with paralysis, my brother had a bleeding spell, and I was the only book and job printer in the entire establishment. By laying a series of type boxes on the floor around the press, I could set up jobs and work them off on the press, and customers used to come into the office and bring work, out of curiosity to see

me execute it. No one could be more thankful than myself that not a single copy of the work at that time has ever been preserved.

STARTING OUT FOR MYSELF

When I was thirteen years old I was let out as a finished workman, and it nearly finished me. My boss at that time was formerly lieutenant-governor of the State, who took up printing almost as a pastime, and who was a kind-hearted gentleman. One day a man came rushing into the office in wild confusion and haste, and said, "Old McConnell's mare has been stolen, and we want some posters printed right straight off, so we can stop the thief, if possible." The job was turned over to me. I was proud to be designated as the one to do that piece of work. So in all haste I set up the job in great primer antique (and it took all of that font we had), put a scarehead upon it, locked up the form and started to carry it to the press. When I lifted the form from the imposing stone, it slumped. I was in despair and, boy-like, would liked to have run down to the mill pond and drown myself; but my boss, who, as I said before, was a gentleman, rose from his desk and re-distributed the type in the case and I set the job over again. At the same time he was talking in the calmest, gentlest way possible of matters that were entirely independent of the work in hand, and so eased me down. It is not too late in life to commend his example to other master printers, as well as to foremen generally. Well, I suppose I must indulge in a little personal reminiscence — I have not so far.

When I was in my fourteenth year I came to the village of Boston and let myself out as a compositor,

receiving the munificent wages of a shilling per thousand ems: 16⅔ cents. I earned a living, however, and at the age of sixteen, owing to the disaffection of the foreman, who had a quick temper, I was installed in his place as foreman.

FOREMAN'S DUTIES

Now let me tell you what I did as foreman. I set all the advertisements of the weekly newspaper, read the proof, made up my paper, and sent the forms to the press. Then the papers were brought back to the office and folded. My brother and I folded the papers. Afterward, when we ceased folding papers, it was my duty to address the mailing list. Then the bundles were done up in the office and carried off to the post office. One time the boss came tearing into the composing room and, in a most frantic way, said, "Thomas, they have pied a form down to the press room; what shall we do?" I replied, "The only thing I know of, is to go and pick up the type!" Then, with a look of stern indignation, he turned on his heel and shouted, "Thomas, this is no time for levity." I don't suppose it was.

We had a change of proprietors about a year or two after that, and the new proprietor, the moment the papers were signed, which happened to be upon mailing day, stripped off his coat, rolled up his sleeves, and turning to me, who was admiral in charge, asked: "What shall I do now?" I said, "Perhaps you had better help address these papers." He was desirous of making a good appearance in the matter, but I was an adept—not in making an appearance, but in work. As a consequence, I was able to direct about six papers to his one. Utterly disgusted, he

turned to me and said, "I'm afraid, sir, you are showing off," a thing which any one who knows me knows is the farthest from my nature.

The time came when it seemed perhaps impossible to hold me in the smaller lines of a foreman, so I took a contract to set the paper upon which I had been employed, at a certain sum per thousand ems. After a time that did not seem to work off all the surplus energy I had in the house, so I added a job office — a very small one. It was a very carefully selected office, however, and there was hardly a thing in it that was displaced because it was useless. From that time on, I always found people who were willing to have me do work for them. I very rarely have lost a customer through disaffection, and when I lost one I have found two came to the funeral. So cheer up, young fellows, and do not think the heavens are going to fall on your heads if a customer should come in and say that your prices were too high, and that they must look up another and a cheaper man.

GENERAL ADVICE

Now, my boys, all this time you have been working toward the counting room; but you have not yet reached it. When you start in business for yourselves, if you are wise, you will buy a very small printing office, and simply buy the essentials, the indispensables; and then it will be large enough and cost enough, for I am supposing that you are starting an office without bringing your sisters and your cousins and your aunts under tribute. You will begin to do all the work in your office, including opening the office in the morning, sweeping, dusting, building fires, and putting the office in a neat condition.

I want to say now, in capital letters: ALWAYS BE NEAT AT YOUR OFFICE. Never let it look like a neglected mother-in-law, but always as neat as you can make it, with everything in place, including the office towel. When you begin to have the work come to you, whether by canvassing, or otherwise, and you begin to find that you are not able to do all the work, drop the most menial part of your work, gradually leaving off the sweeping, and the dusting, and the building of the fires, and the errands, because you can buy muscle better than you can buy brains. After a while you will have to drop your distributing. After a while you will drop your cutting of paper. Again you will need to drop going of errands, or going outside of your office to canvass for work or to see customers, except in extreme cases. You will send your messengers to do your errands, because, as I just now remarked, muscle is cheaper than brains, and thus you will go on dropping one outside matter after another until after some seventy-five or a hundred years, you may be able to sit at your desk all the time and simply count your ducats. You may mount on your wings like Pegasus, only be careful and remember that, like Icarus, you may get too near the sun and the fastening of your wings may melt, and you be obliged to make a most unfortunate flop — as a good many printers have done; but I hope you will not be among the number. When you are in the counting room, remember that but one policy will work well, a manly, straightforward one. Tell the truth to your customers and dignify your profession. At the same time, do not give away the details of your business, for outsiders cannot understand those things and will take one-sided views of such matters.

THE SAME CONTINUED

Do not decry your rivals, for it may react upon you. Let me give you an incident. A man not far removed from my office, who runs a small establishment, remarked, in giving a price to a customer, "Now, if you should take this piece of work to Todd, he would charge you so much," naming a price higher than his own. The customer coolly inquired, "Where does this Todd keep his office?" and the unfortunate printer had to give the address of Todd's office. The customer came immediately to me, has proved to be a very profitable one, is perfectly well satisfied with his work and the prices, and it was only a long time after he had been my customer that I learned of this incident. Remember, my fellow craftsmen, that you are expecting to be in business for a long time, and you wish to keep every customer who comes to you. In these days of fierce competition this is only possible by making it worth the customers' while to patronize you. If he can get the work done better and cheaper and prompter by some other printer, he will leave you without a pang; if, on the other hand you treat your customer well, serve him promptly, charge him a reasonable living price, advise him for his best interest, even if it is contrary to your own at times, you have not only retained a customer, but obtained a friend.

ADVICE TO FELLOW CRAFTSMEN

Likewise, ye masters — for this affords me a fine opportunity to say some things — remember whom you are instructing. Give your apprentices full information, not partial information; instruct them thor-

oughly in the matters that pertain to the craft, because every one of your apprentices is liable to be a master-printer, and, let me whisper tenderly in your ear, it is possible that he may be a better master-printer than you are yourself. Give him a fair field. Give him full instructions. Show that you have an interest in his work and in its being well executed; show him that there is more to you than a simple slave driver, who undertakes to get the most out of his work people, without giving an equivalent. Once in a while it would be well for you to put on your reasoning cap and imagine yourself in the place of your apprentice, and then draw from your well-trained and fertile imagination the inference that your apprentice should draw as to the kind and quality of information that he wished imparted to him. Do not be afraid to give your apprentice information, and give it freely, for in this way you make a friend who might otherwise be a business antagonist. We are dealing in futures — not in the stockbrokers' sense, but in our future living, one with the other. In the future, perhaps near, perhaps far away, your apprentice of today will meet you somewhere round the festive board, or in some other common place of meeting, and you will associate with him on an equality. Therefore, do nothing that shall separate you from your fellow and remain as always his friend. An apprentice to whom I gave some considerable information, perhaps thirty years ago, always hails me as "Uncle Thomas" to this day, and although he is doing a large business in the city, he and I are as chummy as though we had both swept the same office, washed the same rollers, eaten our lunch on the same cutting machine, and gone home together.

VI

LINE AND HALF-TONE ENGRAVING

LINE AND HALF-TONE ENGRAVING

By DAY BAKER, *formerly president of the Sparrell Print, Boston* :: :: LECTURE NO. VI

THE committee having in charge your education as printers has asked me to talk to you this afternoon on Line and Half-tone Engraving, from the standpoint of a practical printer and engraver. I shall not attempt to give you a technical and chemical treatise on the work, nor shall I talk for the benefit of the wise printers here, many of whom probably knew all that I am going to tell you when I was a young man setting type and running printing presses by foot power, getting the practical experience which has been of great value to me.

In following the vocation which you boys have chosen, you will be called on almost daily to handle engravings, either to be printed by themselves, set in forms and printed with type, or incorporated in forms for electrotyping purposes.

Engravings used by letterpress printers (such as you and I are termed, because we print from relief surfaces, letter or type high) may be divided into three classes: wood engravings, line engravings, and half-tone engravings. As the first of these (wood engravings) are now little used, on account of their high cost, and as far better results are secured for most commercial and art work by the more recent photo-mechanical engraving processes, I shall talk only of the latter, which are termed photo-engravings, because of the design or picture being transferred from the copy to the metal plate by means of photography.

Photo-engravings for letterpress printers are divided into two classes — line and half-tone. Line engravings, as the name implies, are engraved plates

which are made to reproduce lines, or drawings or letters composed of lines. By this process only solid or full tones can be produced. Half-tone engravings are engravings which reproduce the half tones as well as the full tones, in contradistinction to the line process, which is suitable only for the full tone or the black. While almost any copy *can* be reproduced by the half-tone process, line engravings are more desirable and practical for many jobs. For instance, while it would be possible to make a half-tone plate from many pieces of copy intended for labels or music titles, which consist entirely of lines and lettering, the work can be more easily, cheaper, and better done by the line process.

That you may better understand the uses of the two classes of engravings, I am going to tell you in as simple manner as possible how line and half-tone engravings are made.

Right at this point I want to impress on you some little rules which I heard from my father almost daily during my boyhood, and these are especially applicable to the making of engravings:

The first, an old saying, "If a task is worth doing, it is worth doing well."

The second, "If you want good results, you must start right."

And the third, "To do things quickly and well, start right."

These rules you can apply to your every-day work in this school for printers; in fact you might say that you are here to exemplify these rules.

First: You are being taught to do things well.

Second: You are being taught one of the great fundamental principles of printing — to *start* right.

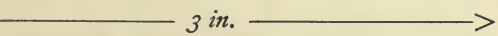
Third: You are being taught to start right and do things well, in order that you may do your task with due speed and not have to do your work over.

And these same rules apply to engraving. If you want a nice, clean, sharp piece of work (and that is the only kind worth having), you must start right—you must have a good piece of copy.

LINE ENGRAVING

We will first take up the making of line engravings, the simpler of the two processes which we are to consider. For a line engraving, to get the best results, the copy should be on pure white paper, and the lines be clear, sharp, and *black*, not blue, blue black, or nearly black, but *black*. If copy be drawn, india ink or Higgins' waterproof black ink makes the best copy. If the copy be a piece of printing, it should if possible be a well-inked, clean, sharp proof on a piece of coated paper, and printed so that the design or lettering will be free from gray spots. A good strong red can be used, as the photographic process takes strong red the same as black. Lead pencil marks, blue, purple, or tints of colors, or half-tones of either black or colors, do not affect the photographic plate so that a line-plate print can be made on the metal.

The copy being prepared in good shape for reproduction, it should be properly marked for size, that the photographer may start the engraving right. The proper marking of copy for the size will save much trouble. The best way is by drawing two short lines



in the horizontal margin indicating the extreme points in the drawing. These should have arrow heads drawn

against them and the two connected by a straight line broken at the centre by a space in which is written the size desired of the dimension indicated. The perpendicular should be marked in the same manner.

It is often desirable to know what the height or width of an engraving will be after one dimension has been decided. This is very easily done by placing a rule diagonally on the copy; the width is the known measurement, the height can be ascertained by measuring from the diagonal formed by the rule to a point where the desired width touches the side of the copy. The distance from this point to the bottom or base line of the copy will give the exact height. If the height is known, the width can be determined by measuring from the desired height on the edge of copy to the diagonal. This will give the exact width.

The original of small drawing was the size of the large panel; it was required to be reduced in width to five picas. In order to ascertain just how tall it would be in the reduced size, the diagonal line was drawn over it. The point at which this diagonal line meets the middle perpendicular line five picas from side gives exact height of reduced engraving.

There is a transparent celluloid sheet made, known as the Prior Scale, divided into fractions of an inch and provided with a diagonal rule which, laid over the copy, gives at once any desired dimension.

The first step in making a line engraving, after securing good copy and having the size determined, is to obtain a photographic negative from the copy of the exact size desired for the finished work. This photographing is done with an ordinary camera, which is mounted on a long stand with an upright board at one end to which the copy is secured. The copy must be perfectly parallel with the photographic plate in the camera, or the photographic negative obtained will be distorted — one side longer or wider than the other. You have probably seen photographs taken where the buildings appear to lean backwards, or where people posed with their lower extremities near the camera seem to have feet of extraordinary size. These are examples of photographic distortion.

Unlike the ordinary photographic negative, which is a reversed image — that is the right-hand side appearing on the left, the same as in type,— the engraver's negative must be the same as the copy, in order that the photographic print on metal be reversed, like type. This is accomplished by placing a prism of glass on the end of the photographic lens, which gives the lines of light reflected from the copy an extra turn, and produces a negative with the image in the same position as the copy. If the prism is not used the photographer must "strip," or remove, the thin film from the glass and turn it over on another glass and thus obtain the desired position.

At this point I should say that in this country *line*-plate and *most* half-tone photographic negatives are made by the old wet-plate process. That is, the photographer makes his plates as he needs them, and puts them into the camera wet. Our more progressive English photo-engravers are having great success

with specially prepared dry photographic plates, which can be purchased the same as ordinary dry plates for portrait and view photography.

After the photographer has made the negative of the copy, he treats it with various chemicals until all black lines of the copy are perfectly clear, and all the white portions appear dense black. Should a photo-engraver find that he has a number of small negatives from which engravings are to be made, he can put them in a special bath, cut the films to small size, remove or "strip" the films from the original negative glass, and place as many films as desired on a single piece of glass, and thus save separate printing on the metal, etching, and proving of each small engraving. Such a combination of negatives is called a "flat."

After the negative is made and properly dried, or a "flat" made up, it is taken to the metal printing room, where it is printed on the metal. Line plates are usually made on zinc 16-gauge thick, although for special reasons they are sometimes made on copper. The metal on which the engraving is to be made is supplied by the dealer ground and polished, but the metal printer gives it an additional polishing with a piece of fine charcoal, and then coats it with a solution of glue which is made sensitive to light, practically the same as a piece of photographic paper. This metal is put in a heavy photographic printing frame with its coated surface in contact with the negative, and by allowing the sunlight, or electric light, to pass through the clear portions of the negative, a reversed print of the original copy is obtained on the metal. The metal plate is next baked over a gas stove, and the portions which we desire to have print become hard and brown, and, after the baking process, will

resist the action of acid. The metal representing that portion of the copy which was white is left bright and uncovered by any photographic film, and unprotected from the action of the acid.

The next step in the engraving process is called etching. The metal plate with the baked photographic print is placed in a bath of nitric acid, which immediately commences to eat away the bright portions of the zinc plate, making them lower than the lines and designs which have been photographed and printed on the metal, and thus making a raised or relief plate similar to type.

After the zinc plate is etched to a proper depth, it is turned over to a finisher, who with a hand tool removes any minor imperfections or ragged edges. The plate next goes to the routing machine, where a man called a "router," operating a tool revolving at 12,000 to 14,000 revolutions per minute, rapidly cuts away all the low, large portions of the engraving, in order that they may not print should a soft packing or tympan be used.

If a number of designs are on one plate, it is taken to the saw and cut into separate engravings, and then nailed to wood blocks, planed to a thickness that with the zinc plate will equal type-high. After squaring the block and sand-papering the edges, the finished cut is sent to the printer, at which point you, as compositors, commence to handle the engraving.

HALF-TONE ENGRAVING

Now that we have the line plate as far as the composing room, let us return to the engraving plant for the younger but more aristocratic brother: the half-tone engraving. The half-tone received its name on

account of the fact that by this process the engraver can produce not only full tones, the blacks, but the grays or half-tones of the copy.

In the early eighties of the past century, Mr. Frederick C. Ives of Philadelphia invented the now well-known half-tone screen, which consists of two plates of glass ruled with diagonal lines, the spaces being just equal to the width of the lines. The two plates when put together with the lines running at right angles, present a screen containing thousands of small squares through which the light can pass. It is through a screen of this kind that the negatives for half-tone engravings are made.

We speak of an engraving as being "100 screen," "125 screen," or "150 screen," meaning that the half-tone negative was made through a screen on which the lines were ruled 100, 125 or 150 to the inch. As the spaces between the lines are equal to the lines it means that the lines themselves are only one two-hundredth of an inch wide in a 100-line screen; one two-hundred-and-fiftieth of an inch in a 125-line screen, and one three-hundredth of an inch in a 150-line screen.

For practical use, 65-, 85-, and 100-line half-tones are best adapted for the newspapers printing on rotary presses. You can see engravings made with such screens in most of our daily papers. Engravings of 120-lines are seen to best advantage in magazines using a fair grade of sized and calendered paper, such as the *Ladies' Home Journal*, and *Munsey's*. This size screen makes good bright half-tones which print with ease. Engravings of 133 and 150 lines are used for good grades of book and magazine illustrations and catalogue work, where coated paper is used;

while for the highest class of work, 133 and 200 lines to the inch are used. The two latter screens are rather too fine for the *ordinary* printing office, as they require the best coated paper, the best rollers, presses, and ink, and most skillful pressmen. Half-tone engravings are made as fine as 400 lines to the inch, but they are not suitable for commercial purposes.

Many of the operations in making a half-tone engraving are similar to those employed in making a line plate.

In the first place the work should be started right. Too much emphasis cannot be placed on *starting right* if you want good half-tones; and by this I mean that the copy should be right before it is placed in front of the camera.

The photograph as it comes from the customer sometimes makes a satisfactory copy, but often it is poor, and by its use in that condition you will surely get an indifferent half-tone. In order to secure the best results copy *should* be turned over to an artist who makes a business of removing any defects, darkening or lightening shadows, brightening the high lights, putting in back grounds or vignettes where desired, and have him put the photograph in such shape that it will be *good* copy, and capable of making first-class engravings. This is not necessarily expensive, as frequently fifty cents to one dollar spent in this way will work wonders; but for fine machine work it is no uncommon matter to pay from ten dollars to twenty-five dollars for artist's work on photographic copy, while the actual charge for the engraving itself may be less than half that amount.

With our copy properly prepared, it is placed in front of the camera, and a negative is made the same

as for line work, except that in this case a half-tone screen of the desired fineness is placed directly in front of the photographic plate in the camera. The negative is made through this screen and, when it is developed by the photographer, shows the design or picture broken up into innumerable little squares and dots.

The half-tone negative is printed on a sheet of polished copper, in practically the same way as the line-plate negative is printed on the zinc. After the print is made on the copper it is baked until the enamel is hard and acid-proof. A close examination of this print on copper will show many fine lines and dots where the copper is left bare. This is the result of photographing through the half-tone screen.

The next step is to place the copper plate in a bath of perchloride of iron, which rapidly eats away the copper left bare by the action of the half-tone screen. All of the etching is not done at once. The first bath is called a flat etch. After the flat etch, the plate is carefully examined, and such parts as are required to print very black are covered with a substance much like asphaltum varnish, which is acid-proof. The plate is again placed in the acid bath, and the light portions of the plate are allowed to etch until the high lights, or lightest tones in the engraving, are represented only by very small dots of copper. This process is often followed by the etching of any special spots desired lighter, by means of a camel's-hair brush dipped in the acid and applied as the skill of the etcher may dictate. Sometimes, especially on fine machine work, the highest lights are cut out by a sharp tool in the hands of a hand-tool engraver. This gives the engraving added brilliancy. Some-

times the strongest shadows are rubbed with a smooth piece of steel, called a burnisher, which makes the printing surface much smoother and more compact, thus making the engraving print more solid at the points burnished.

After the plate is satisfactorily etched and small imperfections removed by the finisher, the line or bevel is cut on a lining and bevelling machine. The proofs of the engraving are taken on a hand-press for the customer, and it is then blocked and sent to the printing office.

It is at this point that you, as printers, commence the handling of the engravings. Should it be your duty to receive engravings, you should at once open the package, examine the plates to see that they are free from scratches, and like the proofs sent. They should then be tested by a type-high gauge, and if found too high or too low, or scratched, they should at once be returned to the engraver to be remedied. An engraving slightly low is all right, as it is very easy to build it up, but an engraving too high must be planed type-high or reblocked, and should at once be returned to the engraver for correction in height. A high engraving introduced in a form, especially for a cylinder press, will cause the pressman considerable trouble, and in addition the engraving will be badly worn with a comparatively short run.

Should the engravings be found of proper height, free from scratches and other imperfections, the number of the job for which they are intended and the customer's name should be written on the blocks, that the compositor may have no difficulty in getting the engravings in the right jobs.

Engravings should not be piled one on top of an-

other, without a card between, as the blocks that come from an engraving shop are liable to have small sharp copper chips adhering to them, and these sharp chips scratch very deep. Nor should the paper which comes from the engraving shop be used, as this frequently contains some of the small sharp chips.

When handling engravings it is always desirable to *lift* an engraving, and never slide one over the other, even if there is a cardboard between, because by the sliding process insignificant particles of grit or dirt will scratch the face of the engraving, and cause defects that cannot be easily remedied.

When engravings reach the compositor for the purpose of incorporating them in the form, it is frequently found that the plate is not square on the block. In place of attempting to justify the block in the form enough out of square to make the plate print in its proper position, it is much better to remove the metal plate from the block, place in its correct position, and then renail it to the block. One of the best ways of removing the plate, is to strike the block down on the imposing stone, face up, with a quick, hard movement. This will start all of the nails, which can then be easily removed with a pair of pliers. When the nails are replaced, they should be driven down well with a small nail set. This prevents their printing when the job is run off. Never pry a plate from a block, as you are liable to spoil its printing qualities. Always remove by drawing the nails.

Before an engraving goes to the press a good, suitable overlay should be provided. This may be made by the Gilbert-Harris zinc overlay process, which consists of a thin zinc plate, etched similar to a zinc engraving; by the Bierstadt-DeVinne process,

which consists of a swelled photographic gelatine print; or by the old, but ever reliable, hand-cut overlay process.

The three-ply or three-thickness hand-cut overlay is made by taking four impressions of the half-tone on about 40-lb. or 50-lb. machine-finished paper. The first sheet is used as a base, but the highest lights may be cut from this sheet. From the next sheet are cut all the high-lights, or light parts of the picture, and then the sheet is pasted on the base sheet. All of the lights and half-tones are cut from the next sheet before it is pasted to the base, and finally all of the blacks or shadows are carefully cut out, and these are pasted on the preceding sheets, thus, in addition to the base, making three thicknesses in the heavy blacks, two on the medium tones, one on the half-tones, and none on the highest lights. The edges of each thickness should be carefully bevelled with a sharp knife before pasting. This overlay will give satisfactory results, and can be used for long runs. With packing and overlays properly prepared 250,000 copies can readily be printed without appreciable wear on the engravings.

When the engravings reach the press suitable underlays should be made which will bring up all the strong or black parts of the engraving, and especially the centre if the engraving is a vignette.

After engravings are used they should be removed from the form, carefully cleaned, done up securely, with faces protected so that they cannot be scratched, and returned to the customer.

Care should be taken to see that a proper and reasonably descriptive receipt is received, to be filed away against the day that the customer again calls for

his engravings, forgetting that he already has received them.

If the engraving is to remain in the office for future use, it should be properly entered in a book, or on a card index, giving the number of the engraving, the cabinet and drawer in which it is placed, the date, and customer's name. This will all save much valuable time when it is next desired for use.

And now, having briefly described the making of engravings from copy to completion, exhibted the work in many of its processes, together with appliances used, given you some suggestions as to desirable ways of handling and using them, I wish to thank both the apprentices and the many employing printers present for their appreciative attention.

VII

THE GOLDEN HOURS

THE GOLDEN HOURS

By JOHN MACINTIRE, *ex-Secretary United Typothetæ of America* :: :: LECTURE NO. VII

BROADLY speaking, my subject this afternoon would not seem to be directly connected with the business of those gentlemen under whose auspicies we are gathered together, yet unquestionably it is connected intimately with that business, as it is with every other possible line of human thought, human intelligence, and human energy. It has a wide scope, possible of many interpretations; but I wish to confine myself to those hours that might deserve this title in connection with the life of every one of you boys as separate and distinct individuals.

In early life we do not appreciate as keenly as in after life all that these three words stand symbolic of. The hours of childhood, when life is bright and the most serious care is the obtaining of all the fun and play possible, would seem to many to be the most joyous, the real golden hours of life. Then there are the golden hours of youth, on the threshold of which you stand at this time, and it is of those I would speak to you now. These are the hours which in future life should speak to you of duties well done; studies earnestly prepared, work with which you were entrusted honestly and conscientiously performed. You should study most carefully the little courtesies of life; extend them to others and make them so properly a part of your existence that your whole manner will indicate the confidence of a clean mind responsive to its duties, active in the discharge of them. Count the day lost which does not see some duty properly discharged, some efforts made for others, some courtesy extended.

When I regard the conditions with which you as boys are surrounded, the splendid opportunities that are being given you to perfect yourselves in a trade—a profession that stands among the important ones that make up the great commercial prosperity of this country, I cannot but think of the thousand homeless boys that I have seen scattered throughout this great country and in the slums of our European cities, doomed to drag out a miserable existence from the cradle to the grave, without hope, without opportunity, seemingly without the interest or sympathy of a single human being. Could you but realize how much you have to be thankful for to the men whose brains and energy, backed by their good will and their means, make possible the opportunities you are enjoying, you would strive by every means in your power to take advantage of these hours and make them "golden" for yourselves, and so fill the lives of those interested in you with gladness and happiness.

Let me ask you a few questions : Are you each one using the hours that you spend here receiving instruction in such a way that this training will tell in all your after life ? Are you seeking to make every hour one of direct improvement, qualifying yourselves more fully to discharge the duties of your chosen profession ? Are you training your mind, your inclination and your temper to govern and overcome all obstacles and the daily temptations common to all ? Are you thus seeking to make future golden hours for yourselves ? For, remember, it is only those who after their training can go out into this great broad world and face it, not as weaklings, with a perfunctory knowledge and a meager grasp of their profession, but as men who can subject themselves to gov-

ernment; for it is the men who have trained their will power, their mental powers, and their tempers to restraint, that are given the power to cope with conditions.

In the business and manufacturing world today we are looking for men, not in the physical sense alone, but men in the fullest sense of the word; men who have confidence in themselves, in that they know they are masters of themselves and masters of their chosen occupation. To such, opportunity stretches her arms; for such, the world still holds rewards and prizes beyond number; for such, this great nation stands ready to provide the opportunity to increase her usefulness and leadership in the spread of civilization and the improvement of conditions of humanity over the entire earth. For these there is open the leadership in great affairs; in large industrial institutions, in our political institutions, and in the affairs of our government in all its branches, stretching from the city to the Federal government at our nation's capitol. For men who will do things there is just as much opportunity and as many rewards today as there ever were; and in these golden hours of youth I would ask you to remember that experience has taught those who have gone before, and who now can look back and review the past years, that youth contained the golden hours of training that bordered on the next great era into which all men enter, namely, that of opportunity; and that just as youth fits itself and by the use of those hours trains itself, just in that measure lies the scope and possibility of its reward when opportunity knocks at the door.

The opportunity presented to you boys through the education given you in this institution should be

thoroughly grasped and improved, by observing a few simple rules in the daily discharge of the duties entrusted to you, either in your school or in your future place of employment. Bring to the work entrusted to you by your employer all the intelligence and forethought that your training has added to your natural ability. Do your work well and do it as quickly as consistent with good and proper workmanship, and remember details. Check your time promptly and properly on the work-ticket, doing this as much for your own benefit as for your employer's; and remember that your lack of accuracy costs your employer money, as it will also cost you money as well as future advancement and opportunity. Make the minutes count, for this will mean a full measure of appreciation from your employer and also add much to your opportunities for advancement. In work well done lies the real reward, a future fitness for greater things; and if you will but take this view of life into the discharge of your daily duties, not only will your material prosperity be advanced, but from it will come a moral strength much more to be desired because of its bearing on your own individual happiness and that of your family and friends. The mind fully occupied, controlling the physical condition, gives one the strength to resist temptation; and in this physical and moral strength lies the secret of future happiness and greatness.

No doubt, as boys, you have read many of the tales of chivalrous knights of old, who accomplished great feats in legend and story, and probably some of you remember that famous knight, Sir Gallahad, who went forth to accomplish great deeds and of whom it is recorded, "Like the strength of Sir Gal-

lahad, which was as the strength of ten, because his heart was pure." This is the strength which means not only the strength of physical manhood, but also the strength which makes for success in all a man's undertakings.

Opportunity, despite all that is said to the contrary, is not the result of natural selection, but the fitness to grasp the situation and make the most of it. Could you boys understand life as men who have gone through the years of experience upon which you are but just entering, and realize what advantages and opportunities are being offered you within these walls, you would feel that you could not afford an idle moment, nor even an idle thought.

To some of you the discipline of school may seem too severe, the requirements of your teachers too exacting, but remember that discipline, obedience to instruction, and the spirit and inclination to carry out such instruction, are the only successful methods to fit men to command. He who cannot obey, who cannot follow, does not possess the qualifications of a leader or director of others; therefore I ask you to remember that in the pursuit of your occupation, wherever your lot may be cast, no matter how distasteful or how seemingly out of place your orders may be, it is your duty, so long as you remain in such a place, to carry out your instructions and orders in accordance with the wishes of those who may be directing affairs.

Avoid discontent at all stages of your career, except it be that discontent which means dissatisfaction with yourself because of work improperly or poorly performed. Never be discontented with your progress because it is slow. A clean record, a good name, and

a reputation based upon the discharge of duties well done, tasks fully accomplished, abilities possessed and used to their fullest, carry a reward the measure of which is far beyond that of money recompense.

And now just one word in conclusion: As you go through life remember it is the little things that count; the things which seemingly are of no moment to anyone, which no one but yourself would seem to know about; the trifles, or what would appear to be trifles to you, that would go unrecorded. When you see your features reflected in the mirror, you should be conscious of no act, no thought, that would cause regret or the blush of shame. Remember above all, that it is the boy who can look his mother straight in the face, feeling that he has committed no act which he would be ashamed to tell her, that becomes the successful man.

VIII

ELECTROTYPING

ELECTROTYPING

By JOSEPH H. WARE, *of H. C. Whitcomb & Co. Boston* :: :: :: :: :: :: :: LECTURE NO. VIII

ELECTROTYPING is a process of making copper-faced duplicate plates from engraved cuts or type forms, for printing purposes, and is, as compared to printing, a comparatively new discovery.

The first electrotypes for printing purposes were made by a Mr. Adams, in New York City, about the year 1840, and were made by depositing the copper directly on the wood cut, and thus making a matrix, and then depositing again on the matrix and making the printing plate. This method destroyed the wood cut, was expensive, and was not carried on to any great extent.

About the year 1842, a Mr. Wilcox, who was employed by Davis & Co., mathematical instrument makers of Boston, made the first electrotype that was ever made for printing purposes, by taking a mould of the type form in gutta percha. This was a page of type of a catalogue, and was used with the other type pages to print the catalogue from. Mr. Wilcox then started in business and carried it on until about 1855, when he sold out to the New England Type Foundry, who carried on the business for several years. Since then the business has gradually grown until at the present time there is annually turned out in the United States alone over two million dollars worth of electrotypes.

THE FIRST ELECTROS

I will now give you a brief outline of how electros were made for many years, and the time it took, and

then give you a detailed illustration of how they are made to-day and the great saving of time that is made by the modern methods and machinery now in use.

Electros were first made by moulding in wax about one-fourth of an inch thick, then brushing the mould over with a soft camel-hair brush with plumbago or black lead, this making a metallic surface to conduct the electricity, the wax being a non-conductor. The mould was then immersed in alcohol, which expelled the air, and was then hung in a bath, which is a solution of blue vitriol and sulphuric acid, each mould being hung on a rod in front of a sheet of copper or annode. The action of the electricity through the solution decomposed the copper and deposited it on the mould. Formerly all moulding was done in the day time and then all the moulds placed in the battery and allowed to run all night, then taken out and backed up in the morning.

One reason for this was that the fumes from the battery, caused by the action of the sulphuric acid on the zinc and silver plates, which was necessary to produce the electric current to deposit the copper, made it impossible for the men to work in the room with it.

Since the invention and application of the electric dynamo machine to electrotyping, about the year 1882, these fumes have been entirely done away with, and the time of depositing the copper shell has been reduced from about twelve hours to an average of about three hours.

PRESENT-DAY METHODS

At the present time the form of type or engraved cut to be electrotyped is first locked up in a chase,

with strips of metal all around it the same height as the type or cut, and about one quarter of an inch thick, and are for the purpose of preventing the slide of the wax in moulding and also to protect the edges of the plate in the subsequent operations it has to go through; these strips of metal are called bearers or guard lines.

THE MOULDING PROCESS

The face of the type or cut is then carefully cleaned with benzine and a soft brush. The surface is then lightly brushed over with very fine plumbago or black lead. A flat piece of metal about one-eighth of an inch thick, called a case, is prepared for the mould by pouring on it melted wax to the thickness of about one quarter of an inch. After this cools, it is run through a shaving machine which makes the case the same thickness all over; the surface of the wax is then brushed over with black lead, the same as the type or cut has been, and is to prevent the wax from sticking to the type. The type or cut is then laid face down on the wax and placed under a powerful power press, which causes the wax to enter the finest lines of cut or type, so that the mould is an exact fac-simile of the original.

This mould is then trimmed down flat, where the wax has splurged up by the pressure in moulding, and the blank spaces are built up on the mould, so that they will be lower in the plate and will not take the ink and black the paper in printing. This building up is done with a hot iron by melting the wax and running it on to the mould where necessary.

After this, the mould is placed in the black-leading machine and run under a slot, and the black lead is

driven through this slot by a powerful blower which thoroughly covers the surface of the mould all over with black lead. This is a very important part of the process of electrotyping, as the black lead makes a metallic surface on the mould and makes the wax a conductor of electricity, and although this surface of black lead is only a very thin film, it must cover every part of the mould or the copper will not deposit. The mould is then placed over a blower and all the loose lead blown out, and a piece of thin copper placed on the face and at the top of the mould for the hook used to suspend the mould in the solution to rest against, and make the connection with the metallic surface of the mould, and carry the electricity. The mould is then placed under a jet of water from a powerful steam pump to expel all the air from the indentations in the mould. This is a necessary operation, as the copper would not deposit in the letters unless the air was expelled.

THE ELECTRO DEPOSIT

The mould is then covered with a solution of sulphate of copper, and very fine iron filings sprinkled over it, which produces a thin film of copper all over the mould, and causes the copper to start depositing all over the mould at once, instead of starting at the connection and gradually covering the mould, as would be the case without this process. The mould is then placed in the depositing tank, which contains a solution of sulphate of copper (blue vitriol) and sulphuric acid in water, and is connected by two copper bars with the poles of a dynamo electric machine. The mould is suspended by a copper hook on a copper rod; one end of this rod rests on one of the bars,

which connects the tank with the dynamo, the other end being insulated by means of a piece of rubber. A plate of rolled copper, one half an inch thick, called an annode, is placed in front of the mould and suspended in the solution by another copper rod having one end insulated, being the opposite end from the one on which the mould is suspended, the other end resting on the other connecting bar. One end of the rod, from which the copper plate is suspended, is connected by contact with the copper bar, and through this bar with the positive pole of the dynamo; and one end of the rod holding the mould is similarly connected with the negative pole of the dynamo. The electric current therefore must pass through the solution in the tank, and the effect is to decompose or separate the elements of the solution, and cause the copper, which it contains, to be precipitated upon the metallic surface of the mould by galvanic action. The copper, which is thus withdrawn from the solution, is constantly renewed from the copper plates or annodes which are suspended in the solution. The deposit is continued until the copper shell is of the necessary thickness, about six one-thousandths of an inch, which is about the thickness of one and one half sheets of a newspaper.

BACKING-UP THE ELECTRO SHELL

The case or mould is then removed from the tank and by pouring hot water on the shell it is released from the wax, and, after being washed, is ready to be backed up with electrotype metal, which is a composition of lead, tin, and antimony. The back of the shell is then washed with a soldering solution, and placed face down in a shallow iron pan, and sheets of

tin-foil laid on the back of the shell; and the pan is then floated on the top of the kettle of melted metal, until the tin-foil melts and flows all over the shell.

The pan is then removed and the hot metal is poured on the shell to about one quarter of an inch in thickness. When cool, the casting is taken from the pan, and is ready to be finished.

FINISHING

The casting is then placed on a power planer and the back planed off and the plate reduced to about three-sixteenths of an inch. It is then taken in hand by the finisher to be made level on the face. By rubbing over the face lightly with a flat rubber eraser, the low places are readily seen, and are brought up to the level of the face by laying the plate face down on a polished iron plate and, with a hammer or punch, driving the low places up to the same level as the high places.

After the plate is made perfectly level and straight on the face, it is then again shaved down on the back to the standard thickness of eleven points, type measure. During all these operations, the bearers or guard lines have remained on the plate for its protection. These are now sawed off, and, if a book plate, the edges are bevelled to fit the catches on the patent blocks on which book plates are printed. If the plate is for job work and to be used with type, it is mounted on wood type high.

Imperfections and alterations in plates are made by cutting a hole in the plate and inserting the type and soldering it on the back. Pieces are also electrotyped and soldered into the plate, when necessary to correct them.

Altogether to get out an electrotype, ready for the finisher, there are eight stages or processes to go through, all of which, excepting the first stage or mould, is done, as you might say, in the dark, and the electrotyper does not actually know that he has a perfect plate until it is cleaned after being backed up. There have been, during the last twenty years, great improvements made in the machinery and also in some of the processes used in producing electrotypes, so that the time of getting out electrotypes has been reduced from two days to an average of about three hours. There is also now used about twenty machines where only about six were used formerly. The blackleading of the mould first was done by hand with a brush, and took from one half to three-fourths of an hour; it is now done with the blast machine in one minute.

By oxidizing the mould, as we do now, with sulphuric acid and iron filings, and causing the copper to start depositing all over the mould at once, instead of starting at the connection and creeping over the mould as formerly, we save about one half hour; and by agitating or keeping the solution in motion, which has been done now for about ten years, we save about one hour's time.

We now have a dynamo electric generator driven by a direct connected 20-horsepower electric motor, which will deposit shells of the standard thickness of six one-thousandths of an inch on fifty cases or moulds, 17 x 20, in one and one-quarter hours' time. We have, however, with three presses moulding, never yet been able to get over thirty-two cases into the depositing tanks at one time. I have here some shells of the usual thickness, six one-thousandths of an inch

that were deposited in one and one-quarter hours, and were run with fifteen other cases, 17 x 20, at the same time.

I have here some samples of shells gotten out in much less than the regular time of one and one-quarter hours, and shows what can be done, if you don't care for the expense. We have two tanks fitted up to do this hurry work, and the first shell I will show you was run in ten minutes, and is two one-thousandths of an inch thick. The next one was run in twenty minutes, and is three one-thousandths of an inch thick. The next one was run in thirty minutes, and is five one-thousandths of an inch thick. The next one is the standard thickness, six one-thousandths of an inch, and was run in forty minutes, instead of the usual time of one and one-quarter hours.

I also have here a finished blocked electro that was got out in fifty minutes in this way, — ten minutes moulding and getting ready for the bath; twenty minutes depositing the shell; five minutes backing up; fifteen minutes finishing and blocking.

To get out this hurry work in this time adds very materially to the cost of the electrotype, not only in the extra power consumed, but in the men's time in handling and following the work through the different processes, in both the moulding and finishing rooms.

The advantages of electrotyping are that, in long runs on the press, the electro will stand a great deal more wear then the type, and by making duplicate plates of the same job the cost of the press work can be very materially reduced. Also by setting a few pages of type and having them moulded, then distributing the matter and setting more, the printer can get along with much less material than he could otherwise.

IX

MAKING OF PRINTING INK

MAKING OF PRINTING INK

By PHILIP RUXTON, *Printing Ink Manufacturer, of New York* :: :: LECTURE NO. IX

WHEN I was invited over here to talk to you about ink, I remembered a question a friend asked me the other day, "How can you tell a Bostonian?" Upon my giving it up, he said, "You can't; he knows it all." I consequently felt that if this was their reputation, I guess I'm up against it pretty hard, but I'll do the best I can.

What I don't know about ink would probably fill a book, and yet would you believe it, there are occasional moments when it palls, and I feel like a certain young man of whom I recently heard. He had worked three weeks in a little print shop as the devil — or perhaps it was like the devil, I don't quite recall—and removing to New York again secured work.

At the end of the first week, he applied to the boss for a raise in salary.

"We are giving you five dollars now, Billie, ain't we?"

"Yes, but I give to me mother all I earn."

"All you earn," repeated the proprietor, thoughtfully, "and what do you do with the other four dollors and a half?"

(It took Billie even longer than that to catch on.)

"And how long were you at it before?"

"Three weeks," says Billie, "and the way I'm treated makes me wish sometimes I had never learned the business at all."

There are times when I feel like Billie; when streaks of Cerulean blue get into my ink-tank and my think-tank, and I almost wish I had "never learned the business."

However, if you're not full of quinine, and your ears are in a receptive mood, you are about to hear something. I propose pouring a few crystalline drops of ink hunch on your tympanum, which, if you will allow it to percolate through your unsophisticated gray matter, will put you so ink-wise that, if you meet your old self again on the street, you will want to kick it into the basement. Don't think, boys, that I'd give any ink-dope to a man I'd like to be a brother-in-law to. But, heart-to-heart, if you will apply the wisdom I am about to give you, it's a cinch that it will make a lean bank roll suffer from fatty degeneration which nothing but the library-giving habit can cure.

I gave these facts not a long time ago to a small ink piker in a jerk-water town. He had a bucolic vacuous stare, and buttoned his trousers to his shirt with a nail. The next time I saw him, he had an almost human smile of intelligence, was paying time and a half for night work, and had a twenty-four-horse Panhard.

You have often heard complaint of poor ink. I admit, there is poor ink, but in this age of alertness to get up against it, even in metaphor, is to leave an indelible smear on your presumptive common sense, that should make you ashamed to look a keg of good honest ink in the bung-hole.

But seriously, the manufacture of ink is quite a complicated matter in these days. In the days of old, before it was a business in itself, the printer mixed his own ink on a slab with dry color and varnish, but the volume of printing was small, and this crude way answered the purpose.

Ink is mainly composed of pigments and varnish ground together in proper relation to one another to

suit different grades of work. So the first thing to do, if you intend describing the manufacture of ink, is to give you an idea of the color making. In the first place, the dye, the same kinds that are used for dying cloth, is precipitated on a white base in a huge tank, and thoroughly washed in water, long enough to get rid of all the acid or alkali that may be in the chemicals, which if left in the color would eat off the surface of your plates, so that, generally speaking, when you come across an ink that affects your plates, you will know that the probability is that the color it was made from had not received the proper amount of washing to free it of all the acid. After the mixture in the tank has been tested with litmus paper in order to ascertain if it has been perfectly washed, it is pumped into a filter press, which is a press composed of separate plates, between which canvas cloths are laid. These cloths hold the color as it is squeezed through, and the water is forced out through small crevices in the plates, and runs off, leaving the color between the cloths in the shape of wet cakes, which resemble a waffle. Indeed, if I had described these plates as huge waffle irons it might give you a better idea of them than my description. These wet cakes of color are what is called "pulp" color, and could be made into water colors if you chose.

Our next step, however, is to put the pulp color into a steam-heated mixer, which operation evaporates what water hasn't been squeezed out in the filter press; then we have pure color, which is mixed with varnish and run through the mills.

Of course very few ink houses go into the manufacture of these colors, but buy their colors in the dry state from color manufacturers, but you can easily

see what an advantage it is to the ink maker to know that his colors are uniform and that the trouble of variation in shade or strengh is done away with, thus making it that much easier for him to maintain a uniform product.

An ink mill is a machine with massive chilled iron, hollow rollers, between which the color and varnish are ground together, flowing slowly down the broad spout after running through the three rollers, the attendants helping the process of the mass down the spout with broad-bladed knives such as druggists use, called spatulas. Five, six, or seven times must this mass be run through the rollers before it is delivered to the customer.

Different mills are kept for different colors, some for reds, others for blues, others for yellows, etc., for, as you can see, a red mill cannot easily be washed up perfectly clean, so that a light blue could be ground on it, as the least speck of red left on the rollers would throw your light blue off shade, as would also a speck of blue throw out your yellow.

The rollers being hollow, water can be run through to keep them cool. The when and why for grinding hot or grinding cold is one of the tricks of the trade.

From this you can see that to be a successful ink maker, one must also be a chemist, a dyer, and a color printer, and have, beyond all, the perfect eye of an artist for color. In other words, you hand him a piece of paper and a sketch, he must match the shade and make the inks that will do the work right.

The varnishes used are mainly linseed and rosin oils, the former being used in the better grade of inks on account of the property it possesses for absorbing oxygen from the air. When spread out into a thin

film it forms a smooth, hard coating, which, after drying a few hours, does not rub off. The rosin varnish does not dry so fast, and is used in the cheaper inks which are intended for softer paper where the ink has a chance to soak into the stock.

The drying varnishes are of two kinds, penetrating and oxidizing. The former, as its name implies, penetrates into the paper, and carries the pigment and varnish with it, fixing it firmly. The latter, by the action of the air, dries the color on the surface when the stock is of such a nature that it cannot be penetrated. Light blue and greens, for example, do not penetrate readily, and for this reason such inks remain on the surface and chalk off when rubbed. The air dryer prevents this, fastening the color hard to the stock. Copal and dammar varnishes and most of the raw gums are imported from the west coast of Africa to this country, where, after proper preparation, they are made into varnish.

The rosin and linseed varnishes are made in America. The latter is very often adulterated, and this causes a great deal of trouble in the working of printing inks. The principal adulterants are mineral and fatty oils, such as cotton seed, niger seed, and even fish oil. These are all much cheaper than linseed oil, and this accounts for the great variance in price of "pure" linseed varnish. Pigments are also adulterated to meet price requirements, and the adulteration of both pigment and varnish explains why one ink manufacturer charges a dollar and half for an ink, using pure material, and another charges only a dollar, using adulterants which do not show in the name or in the looks of the ink, but which do influence its working quality and covering capacity.

Pigments are derived from three sources, and may be arranged according to their origin as follows:

Mineral kingdom — Native pigments, artificial pigments.

Vegetable kingdom — Native pigments, lakes and indirect products.

Animal kingdom — Native pigments, lakes and indirect products.

Among the native mineral pigments, genuine ultramarine blue stands first in brilliancy of color, and although matched artificially it will never be equalled for transparency and durability. Yellow ochre, raw sienna, raw umber, and Indian red, are all made of imported earths.

Artificial mineral pigments are derived through chemical action, and include such colors as vermilion, artificial ultramarine blue, Chinese white, pure scarlet, emerald green. In fact, the advance in chemistry has been so rapid that almost any pigment can be closely duplicated by artificial means.

Gamboge, a gum from a tree in Ceylon; indigo, from the leaves of the indigo plant; madder lake, from the roots of the madder plant; and yellow lake, from the quercitron bark, are some of the pigments of the vegetable kingdom. Indian yellow, a deposit from the urine of the camel; sepia, a secretion of the cuttle-fish; carmine, made by crushing the cochineal insect; and indirectly, lamp-black, the soot of burning vegetable oils, are products of the animal kingdom.

All pigments are not suited for printing ink making. Many of them, while extremely useful in other ways, do not possess the chemical properties for com-

bining with varnish and producing the clear, even impression that ink must possess.

Covering power is one of the most, if not the most, important property of a pigment. In comparing samples of different makes of the same color, that sample which shows the strongest covering powers is esteemed the best, other qualities being equal. Covering power varies greatly in different pigments. Some pigments are recognized as being transparent and are used as such. Carmine, lakes, ultramarines, etc., belong to this class.

Coloring power is not infrequently confused with covering power, but it is a distinctly different property from the latter. For example, a color may possess great coloring power, and be sadly deficient in covering power. To illustrate: Prussian blue is one of the most powerful coloring pigments known to the color world, yet in body it is almost transparent. This color and others of the same characteristics are therefore chiefly dealt with from the point of coloring power. But "other pigments are used," as Hust tells us, "solely on account of their covering power, and then color is immaterial."

In making ink, great care must be taken as to the order in which the different ingredients are added. Some colors must be ground hot, some fast, and some slow, and it is the "know how" in doing these different things that constitute about ninety-nine per cent of the formula.

The kind of paper stock used should determine the grade of ink. Heavy, rough, colored papers need entirely different ink from smooth, white paper, and require opaque colors—that is, ink made from such pigments as do not allow the color of the stock to

reflect through them and transmit this color into their own. A transparent red printed on a green stock turns brown, but an opaque cover ink retains its own color because it is so dense that no light is able to penetrate through it. Cover inks should be of a heavy body and so full of color that one pound will have almost enough color in it to make two pounds of ordinary transparent ink. Great care is used in selecting the pigments for these inks, and only those are used which are known to have great covering capacity. Ink for enamel-coated papers is of an entirely different nature, and must be made in accordance with the surface of the paper. The tendency of the paper manufacturer, during the last few years, to cheapen the price of his enameled paper has caused the ink-maker no end of trouble and annoyance. Many batches of ink are condemned when the blame should justly be carried to the door of the paper-maker, who nowadays scarcely delivers two orders of the same kind of enameled paper with the same printing surface. Some of the largest paper houses in the country mark their samples "These samples refer to present stock only."

The best results in halftone black printing are obtained by carrying the body of the ink just as heavy as the surface of the paper will stand, and by using an ink which is so black that a black impression is left by carrying very little ink. The tendency of most pressmen is to reduce with varnish a halftone black which picks an enameled paper; this is altogether wrong and should never be resorted to when the work is high-grade and a clean, sharp halftone is desired. The varnish is colorless, and while it takes out the tack it destroys the color. Linseed

varnish is made in many different grades, each grade depending upon its tack.

The ordinary halftone black is ground in what is called No. 1 varnish, this grade being best suited to print without picking on the larger percentage of papers. The successful pressman on halftone work will order from his ink-maker a black ink ground in No. 000 varnish, which is three grades softer than his regular ink. Then, if the ink picks, he adds this sort of ink to his regular kind and takes out the tack without destroying the color, for the only difference in the two is that the softer ink is ground in the soft varnish; it contains just as much black pigment as the heavier ink. By adding the soft ink, a little at a time, it adapts itself to the surface of the paper without softening the ink any more than necessary. Reducing of black with varnishes causes the work to look gray and the ink to crawl along the edges of the cuts. Halftone blacks for platen presses should be of the very best quality, because the distribution is not nearly so good as on cylinders. The ink-maker usually makes what he calls job-press black, which is heavier bodied and more like butter.

Job blacks are made heavier and stronger than halftone blacks intended for enameled paper. They have a longer, more stringy body, and dry more quickly and harder, being ground in stronger and more tacky varnish. This ink would pull the surface from an enameled paper, and should only be used on bonds, linen, and hard-surfaced flat papers. The lithographer uses a heavy-bodied black, but it is of a softer nature, and different from the letterpress printer's job black.

If it is desired to lessen the tack in job black, add

a little halftone black, and in printing on laid or wove papers the best results are obtained by mixing these two, half and half.

White inks may be divided into three classes: cover white, mixing white, and transparent white. Cover white is made as heavy and opaque as possible in order that it may cover up the rough surface of a cover paper, for printing white alone, or in mixing tints for this class of stock. It is often used, the same as yellow ochre is used, in house painting for a primer upon which other colors are to be placed. Mixing white is made from a similar base as cover white, but is softer in body and more transparent and is used to subdue the brighter colors, by mixing with them, to form half colors and tints. Transparent white is made with a perfectly transparent body and is used for mixing transparent tints which are to print over darker colors. It is especially valuable in mixing tints where black is used for the keyplate, and the tint run last. It is light yellowish in color and entirely different from the other whites.

The manufacture of reds is a subject upon which volumes could be written. A red which is pleasing to one is wholly displeasing to another. Vermilion is acknowledged to be the proper shade to harmonize with black, but owing to its poor working qualities is used as little as possible. Some ink-makers have succeeded in imitating this color almost perfectly, without its bad effects. Vermilion is the sulphid of metallic mercury, and as it contains mercury and sulphur is very injurious to the metals used in plate-making; whenever used on long runs the plates should be nickel-typed, that is, covered with a coating of nickel. Vermilion may be detected by heating

on a porcelain dish over a Bunsen burner, when it will burn with a pale-blue flame and with the odor of sulphur. Heated in a tube out of contact with air it turns brown, then sublimes in the form of red sublimate. It is very opaque and has great covering properties, is insoluble in water, alkalies, and any single acid, but a mixture of nitric and hydrochloric acid dissolves it with a formation of a colorless solution of mercuric chloride. Very few substances are capable of attacking vermilion. This ink should not be used at all on half-tones, or solids on enameled paper, as it does not lay smoothly.

X

PRINTING PRESSES AND PRESSWORK

PRINTING PRESSES & PRESSWORK

By JAMES BERWICK, *of the Norwood Press, Norwood, Mass.* :: :: :: :: LECTURE NO. X

IT was not till the year 1800, or about three hundred years after the invention of printing, that any improvements were made in the printing press. The Franklin press (so called because Benjamin Franklin worked on it), to be seen in the upper room of the Old State House, is perhaps the oldest style in existence today. We also have one of these treasures at the Norwood Press. Then came the Ramage press, one of which can be seen at the rooms of the Franklin Typographical Society. The Franklin press has a frame made of wood, and a bed also of wood, with a slate slab to place the form on, and a wooden platen. This platen was only half the size of the form, so that when an octavo form was on the press the bed had to be run in only half way first, the bar then pulled over, then run in the rest of the way and pulled again on the other half of the form, to complete the impression on the whole sheet.

IRON HAND PRESSES

The first iron press was invented by Earl of Stanhope. In this press the platen was as large as the whole form. The old printers, when I was a boy, talked about a two-pull press and a one-pull press. They had all worked on the old wooden press. I think that the house of R. Hoe & Company made the first iron press in this country. Later than this time they were made by Isaac Adams of South Boston and Otis Tufts of East Boston. In my early days all the nice work was done on the hand presses. The Riverside and University Presses had about a half dozen presses each.

FIRST CYLINDER PRESS

The first practical cylinder press was built in England by two young Germans, König and Bauer. These men interested Mr. Walter of the *London Times* in their invention and he furnished the money and a room and the press was built in secret, as they were afraid that the laboring people, with their prejudice against machinery, might destroy it before it was finished; and one night when the hand pressmen were waiting to go to work they were informed that the paper was all printed on the new press. König and Bauer went back to Germany, and the king gave them an old cloister at Oberzell near Wartsburg, encouraged them, and to-day the König and Bauer concern have grown from the crude "Walter Press" of 1812 to be one of the largest in the world, making the very latest styles of modern fast presses.

INK BALLS AND ROLLERS

On the hand presses the ink was put on with "ink balls," the workman putting a dab of ink on one and then striking them together, distributing it evenly over the surface; then going over the form, dabbing it on till the whole form was covered.

The power press caused the invention of the roller. This was first made of the same material as the dabbers — some soft material on the inside and covered with sheepskin. This was followed by the glue and mollasses roller, and some forty years ago glycerine was substituted for mollasses, the roller of the present day.

BOOK PRESSES

As New England had at one time almost all the authors in the country, Boston and Cambridge natu-

rally did most of the book printing, and very properly the first successful book press was invented here by Isaac Adams. Ruggles also took out patents, and others, but the Adams was for many years the only *book* press.

Mr. A. K. P. Welch of the University Press, Cambridge, went to Europe and studied the methods there and came home and practically invented the the modern stop-cylinder, and I think that the original presses of his are running there to-day. Then came the two-revolution, which has become the most popular press of the present day for almost every description of printing.

Before this the cylinder press was considered only fit for poster and other rough printing. The machine shops had no machinery to do finished work, and the gears were all cast with the teeth on. Mr. Welch introduced his stop-cylinder in the later fifties or early sixties, but as almost all editions of books were small in those days (500 copies being a good average) it was much cheaper to work them on Adams presses, these stop-cylinders being used almost wholly for illustrated work.

EARLY JOB PRESSES

S. P. Ruggles, who was a contemporary of the Adamses, invented several small or job presses and monopolized for a while that line of business. There was the "Engine" press, where the form was upside down and the type continually dropping out; the "Combination," the "Bill-head" press, and the "Diamond" card press. Seth Adams, a brother of Isaac, also invented a job press, and then came Mr. Gordon with his press, putting all the others out of

business. As you all know the Gordon and Universal presses, I will not talk about them; and this brings to an end the subject of presses and we come to the making ready of the form.

PAPER PRINTED DAMP

In the old times almost all paper was dampened before printing — book, newspaper, and even rough-surfaced writing papers. Almost all papers came in folded quires and the quires were run through a trough of water. This was part of the morning's work. The water would soak through the paper in a few hours and in the afternoon the quires had to be opened out on a board and the pile of paper put under pressure over night to be ready for next day.

The packing — as you would call it today — was a cloth or rubber "blanket," as we called it. The impression dented into the paper and when the ink and paper was dry enough it was put into a hydraulic press to be smoothed out.

We all owe a great deal to the job pressman. He was the first one who used a hard or paper packing, having a small press easy to experiment with; and the book pressman began to follow his example by putting a few sheets of paper in his packing over the blanket, and continued to increase the number of sheets till he finally dispensed with the blanket altogether and used nothing but paper, and now hard packing is the rule.

MAKING READY

When you put a form on your press to get ready, be sure your press is running well, well oiled, and, above all, keep it clean. A dirty press is a sign of a

shiftless pressman. Put in the right number of sheets for a blanket and have your tympan sheet drawn tight. If it is a cylinder press, be sure that you will have just the right amount of packing on the impression cylinder when your last sheet is drawn on tight, so that the bed and cylinder will run together; that the bearers on the bed are properly adjusted — just a paper or so above type high, and if plates or blocks are in your form, see that they also are just type high. You should always have a type-high gauge handy for this purpose. Have your rollers in good order and properly adjusted. Poor rollers will not do good work, and I think the pressman of today does not give the attention to his rollers that he should. When I was a job pressman I always kept on hand at least two sets of rollers for each press. This was not extravagance, but economy. And, while running, keep the color uniform through the whole number — a good plan is to keep a sample color sheet to compare by. Nothing gives a pressman who is interested in his work more satisfaction than to run through a pile of his printed job and see that the color is uniform. After you have learned to make a job ready in good shape, it will be some years before you can keep a uniform color.

GOOD MATERIALS NEEDED

One of the best pressmen I ever knew, when I was young, said to me: "I find it difficult to do good press work when I have everything of the best to work with." Now, while a good workman can do wonders with poor material, it always pays to have everything of the best. In the first place, it is poor economy to use poor ink. You will require several

kinds for the different papers and cards you may use, and have the best of its kind. It is a mistake to try to get a good color with an ink that has not the color in it; you have to put on too much and are liable to have the job offset or smear, while with a first-class ink you would run a less quantity and still have a full color and the work clean.

HALF TONES AND GOOD PRESSWORK

About thirty years ago the printing business was revolutionized by the introduction of the halftone engraving. There were other photographic processes, but the only one worth talking about was the halftone. This demanded a smooth, close paper, and the coated came on the market and is still the only paper on which halftones can be printed with the best results.

I believe that nothing will give a printing office a good reputation quicker than good presswork. Fifty years ago Harper & Brothers had the best reputation in the United States. The Harpers were pressmen.

Then when Welch of the University Press introduced stop-cylinders and the old publishing house of Fields, Osgood & Co. issued a line of books under the supervision of Anthony, the wood engraver, the University jumped in the front rank; and the fine presswork on the *Century Magazine* did more than anything else to make De Vinne known as the first printer in the United States. You can put all the artistic instinct you have in presswork. While a man may print type or cuts of machines good, without the artistic instinct he will fail on landscapes. He should know how a picture should look, and I think at the present time when illustration plays such an

important part in all catalogues, the pressman is a very important factor in our business.

As a successful pressman, you should, whenever you put a new job on the press, look at the clock and calculate how long it should take you to make it ready and how long to run it off, and try to do it in the time. Don't be afraid of doing too much. If some slow coach in the office tells you that you will get no thanks for doing so, tell him that you are working for money and position, not thanks, and you will in all probability get all these.